SCIENTIFIC AMERICAN

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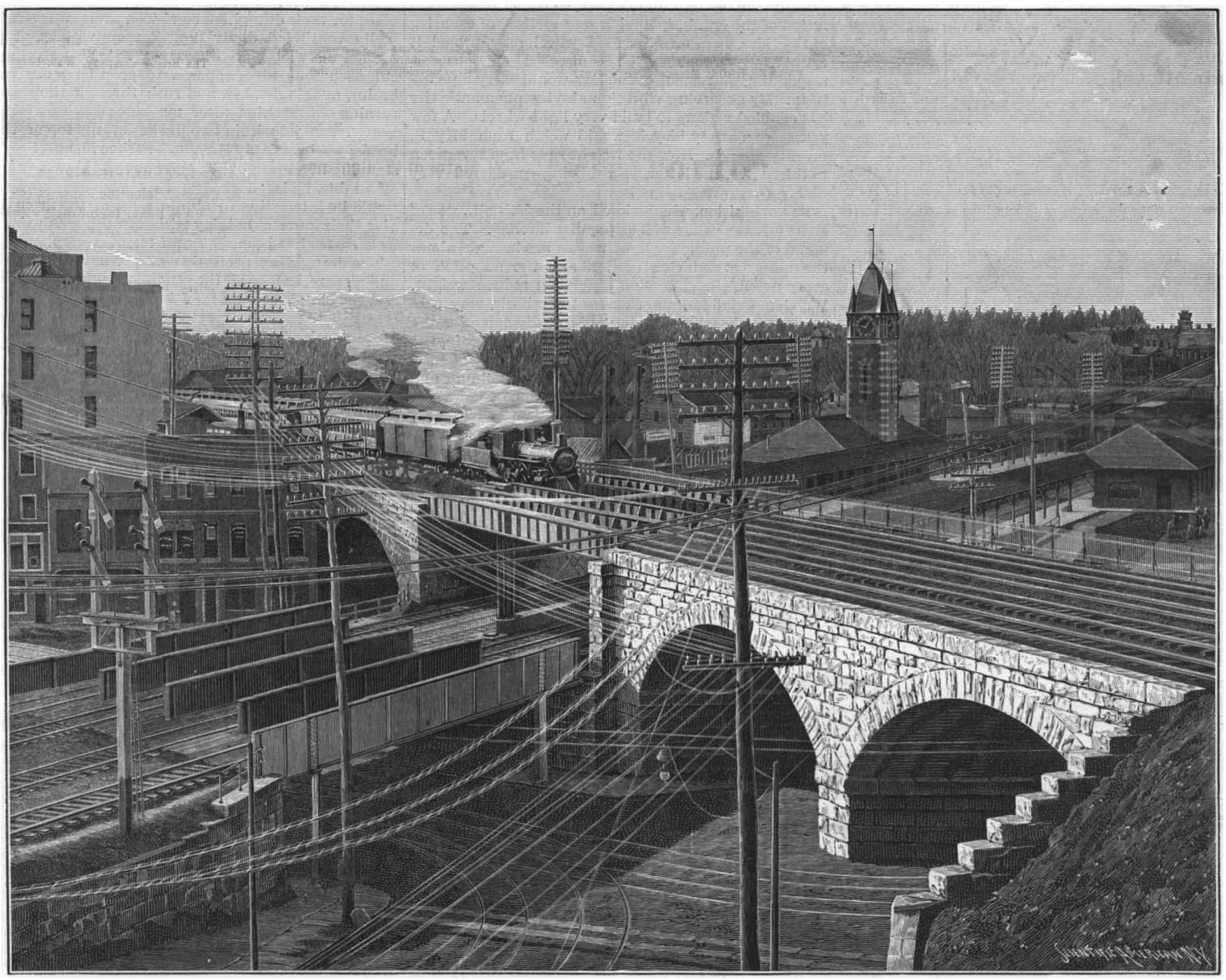
THE CROSSING OF THE CENTRAL RAILROAD OF NEW JERSEY AND THE PENNSYLVANIA RAILROAD IN ELIZABETH, N. J.

The city of Elizabeth, N. J., is traversed by the main lines of the Central Railroad of New Jersey and of the Pennsylvania Railroad, the two roads crossing each other at Broad Street in the heart of the city. For many years this intersection of two railroads and street has been a center of great danger, not only from the liability of collision of trains, but from the possibility of accidents to street cars, ordinary vehicles or pedestrians. The problem of doing away with the grade crossings within the city limits was taken up some time ago, and our illustration shows the solution of the trouble at the point specially alluded to, a solution now practically completed and forming one of the most striking examples of railroad work erected during the year.

The first step in that direction is represented by the raising of the tracks of the Pennsylvania Railroad. The roadbed is now carried throughout the city on an elevated structure, doing away with grade crossings along its entire line; the work being comparable to that recently done in Jersey City on the same road. The effect of raising the tracks was to bring the Pennsylvania above the level of the Central Railroad, so that each road could be worked without interference from the other.

The original street level, it will be understood from what has just been said, corresponded with the level of the Central Railroad tracks. The abolishment of the remaining grade crossing was accomplished by lowering the street, which was done at the mutual expense of the Central Railroad and the city, so that at present the street, descending a pretty steep grade, passes under both railroads and then rises again to its original level. Over the street the tracks of the Central Railroad are carried on an elevated way of plate girder type, the original level of the Central Railroad being maintained unchanged. The railroads do not cross each other at right angles, and the Pennsylvania Railroad runs oblique to all the streets, and the effect has been that the masonry work represents some very striking examples of skew arches. In constructing these the voussoirs have been so laid as to make the skewing very pronounced, producing a peculiar and very impressive effect. For the use of passengers, enabling them to pass from one side of the structures to the other after purchasing their tickets, tunnels penetrate the masonry work.

As the reader looks at the picture, in the background, characterized by its tower, is seen the Central Railroad station; toward the left of the cut the end of the Pennsylvania Railroad can be seen, while houses on the street whose grade has been lowered face the reader on the left of the cut. In the foreground trolley tracks are seen, so that at this point there are superimposed two steam railroads, one above the other, over a street and trolley line. By keeping in mind the fact that the lower railroad represents the original grade of the street, it can be seen how much the street is lowered, and how much the Pennsylvania Railroad is raised. Some time in the future, when the rest of the Central Railroad tracks may be raised, the city will be free from dangerous crossings.



THE CROSSING OF THE CENTRAL RAILROAD OF NEW JERSEY AND THE PENNSYLVANIA RAILROAD IN ELIZABETH, N. J.

Rapid Transit in St. Louis.

St. Louis spent $5,000,000 during 1893–4 in the improvement and extension of its street car service. There are now but two horse car lines in the city, and the claim is made that for rapid transit St. Louis is ahead of any other city in the country; certainly no Eastern city is so well equipped. It is interesting to note the effect such a system of rapid transit has had on the traffic. Street car officials say they never before had so prosperous a year, and that the returns have been far beyond their most sanguine expectations. The fact has been demonstrated that improved facilities cause people to ride more. The figures are not yet completed, but when made up they will show that street car travel here has increased something like 20 per cent. The ugly feature of what would be otherwise a most gratifying report lies in the fact that accidents have been of very frequent occurrence on the trolley lines, though the assertion is made that even in this particular an improvement is noticeable.

THE Wm. Cramp & Sons Ship and Engine Building Company have earned, as premiums for speed, over and above the contract price, about $750,000 for the two cruisers Columbia and Minneapolis. Up to this time they have received for seven vessels $1,230,000 in speed premiums.

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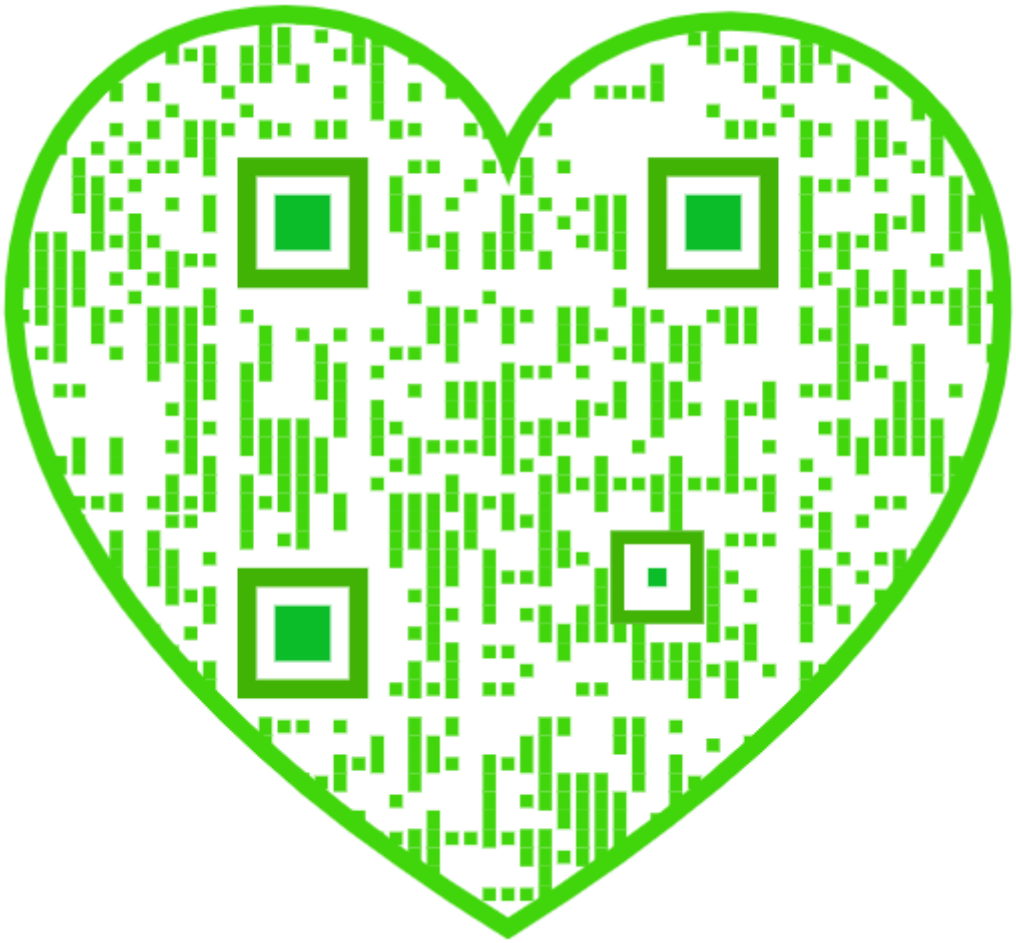

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THE NATIONAL CYCLE SHOW AT MADISON SQUARE GARDEN, NEW YORK.

During the week ending January 26, an extensive bicycle exhibition was in progress in Madison Square Garden in this city. It is the second exhibition of the kind which has been given here, and one which bids fair to become annual.

For years past man has striven to improve the rate of locomotion which he can maintain by his personal exertions. This led to the construction of various forms of velocipedes, until some years ago the conception arose that a two-wheeled cycle might be propelled by cranks on the forward wheel axle. The old velocipede was the result, and as a sport pure and simple, it attained considerable favor. The jarring, weight of the wheel, and incidental hard work proved too much, and it rather suddenly died a natural death. The next change in the development of the cycle was the introduction of the high wheel, with suspension spokes, rubber tires, and very large front wheel. This was a practical machine and rejuvenated cycling.

The safety came in, and ball bearings became a sine qua non on all good wheels. The tires used were of solid rubber and the tendency of the extremists was to make them very small. Then the pneumatic tire was invented, and the modern cycle saw the last step of its development.

The pneumatic tire, by equalizing strains, makes possible the use of a higher gear, so that a single revolution of the crank, involving one motion of each leg of the rider, in a modern road wheel may propel it twenty feet, or four times the distance which a corresponding movement of the legs would carry a pedestrian. By absorbing vibration also the pneumatic tire has enabled makers to build very light wheels. A few years ago a safety bicycle would weigh from fifty to seventy pounds. Now the weight runs from seventeen to thirty-five, the latter weight being considered very high.

The exhibition, which closed on the 26th ult., was of great mechanical as well as popular interest. The demand of the public for light wheels has brought about the most careful construction and the adoption of every possible modification which can reduce weight. Wooden and aluminum rims for the wheels, very thin tangent spokes, light tubing of large diameter for the frame re-enforced at the points of greatest strain, the use of saddle posts of thin tubing instead of solid steel, pedals of improved construction, aluminum and wire saddles, are all steps in the direction of lightness.

The majority of wheels now have wooden rims, aluminum rims being adopted by some very high grade wheels, and steel rims being used on the rest. Among the exhibits some most remarkable examples of wood bending are shown, the material under modern processes seeming to be as flexible as lead.

For a long time past all pedals have been of one type of construction, but not the least interesting feature of the exhibition was the variety of new pedals. Some are really elegant examples of mechanical construction, and are far lighter than the old ones.

Handle bars are made of much narrower span than hitherto, eighteen or twenty inches being an accepted dimension in place of the old span of two feet or more. Cork handles, or handles of cork and rubber combind, are generally used.

Brakes are generally dispensed with, back pedaling or pressure of one foot on the front tire being relied on to stop the wheel. Some very neatly constructed foot brakes were shown, which are attached to the crown of the front forks, and which act by being pressed by the foot.

The re-enforcing of the tubes of the frames near the joints is effected in various ways. A piece of tube may be brazed into the frame tube. In one make cross plates of steel, in another what is virtually an inner triangular tube is introduced.

The hubs of wheels are now, in many cases, turned out of solid tool steel, although very elegant drop forgings for hubs and other parts of the wheel were shown. The crank arms are made lighter, often round in section, instead of rectangular, and many new ways of attachment are shown. The almost universal type of frame is the Humber diamond. Several wheels with detachable sprockets for changing the gear were shown, and there were several examples of mechanism for changing the gear without dismounting. The cranks are brought as close together as possible, in order to secure what is termed a narrow tread.

Another very noticeable movement is in the direction of adjustable handle bars. Many wheels are now provided with mechanism enabling the rider, without dismounting, to raise or lower the handles.

Among the lanterns are two classes of electrical ones. One is supplied by a dynamo driven from a friction wheel bearing against one of the tires; the other is provided with a battery.

Several novelties appear, such as a bicycle with bamboo substituted for the steel tubes of the frame. Another is adapted to be driven by both hands and feet, the handle bars being attached to a lever that is pushed and pulled by the arms, and which connects by a clutch to the crank axle. The same wheel can have the clutch attachments removed and be ridden by the usual foot propulsion. A motor cycle, driven by a gasoline explosion engine, and a duplex cycle, in which the two riders sit side by side, excited much attention.

The great interest taken in cycling was shown by the very large attendance, and under the improved auspices of modern construction, the cycle is becoming more and more widely used. The industry has attained such dimensions that it has led to new processes, to the invention of special machinery, and many other trades are now tributary to it.

ON THE CHOICE OF A CAREER.

The profession of a mechanical engineer, to the uninitiated, holds forth big inducements, and the young man who starts in college works his way along, graduates, and nine cases in ten is assigned a position over the drawing board. Draughting, in its higher forms, is one of the most interesting subjects in existence, especially when other conditions are such as to promote the interest. It rests in the hands of the draughtsman whether the machine will be pulled down several times in order to correct mistakes, and in many cases whether the machine goes to the "scrap heap" or is shipped away a success.

One of the first conditions of good work is a comfortable place to work in. How many concerns in the country, manufacturing machinery, have even a decent place for their draughtsmen? The average is a dirty, badly ventilated, dimly lighted room without proper heat in the winter, frightfully hot in the summer; yet educated men are supposed to go there, use their brains, avoid mistakes, and rush through their work, turning out machine after machine; having a highly heated gas jet within two inches of the top of their heads; yet invariably if a man be taken ill, may be from standing in a draught strong enough to blow a tracing off a table, he is "docked" for the time he is away. It would be interesting to obtain a list of the firms that give their men a holiday without taking a day's pay from their already magnificent remuneration.

The draughting profession at present is a delusion and a snare, as regards the general machinery business, and the old plea that a man is "learning something" is no excuse for a firm paying their head draughtsman $18 per week. A man can keep on "learning something" until he is ready to die of old age, living on small pay. So many people say, "It is so hard to find a good draughtsman." Why, most men who arrive at the age of 30 either get away from the board or out of the business, driven to desperation by the "learning something" basis of pay. Suppose, through nothing but competency, he secures a very remunerative position. Invariably he is obliged to isolate himself from civilization in some small country village, or in some swamp, where many concerns locate their works; and once there he stands a good chance of staying there, unless he is "fired." Some companies, heaven bless them! realize that draughtsmen are human beings, and a roll of honor should be framed for them. There should also be a list of firms that should be avoided by any man who has any regard for fair treatment and health. Long hours, rushing, driving work, contemptible pay, and hopeless prospects take away all interest in the profession, which is certainly on the decline.

"CONDENSATION."

A Trolley Telephone.

A writer in the N. Y. Sun states that passengers riding on the electric railway between West Farms and Mount Vernon have the privilege of listening to an acoustic manifestation that in a remarkable manner illustrates some of the earlier experiments in developing the telephone. The track is a single one and the potential of the current is high; its amperage is also considerable. As a result, when a car is waiting on a switch for one coming in an opposite direction, the approach of the latter is audible at the distance of a mile to the passengers in the waiting car. The sound vibrations are carried along the wire, through the trolley to the wooden roof of the car. This acts as a diaphragm, which faithfully reproduces the rumble of the approaching car. A mile away the noise of the wheels is distinctly audible, and at the distance of 1,000 feet the sound becomes a loud roar. Outside the car, however, practically nothing is heard until the moving car is within a few hundred feet of the switch.

Arc Light Dangers.

Over the street doors of one of our most extensively patronized dry goods stores arc lights are suspended for purposes of illumination. Throngs of ladies are constantly passing to and fro under these lights. We noticed a narrow escape for a lady the other evening. Fire fell from the arc lamp and just grazed her dress as she passed under the lamp. The inflammable nature of women's apparel is such as to render it dangerous for them to stand or pass under arc lights. There should be a law to prohibit the use of open arc lights. It would be easy to arrange a glass basin or plate under the lamp to catch and arrest any falling bits of the ignited carbon.

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The Permanence of Bromide Prints.

AN IMPROVED DEVELOPER.

In a paper entitled "A New and Modified Method of Developing Photographic Prints on Paper with Coal Tar Products in Alkaline Solutions," read by President Henry J. Newton before the photographical section of the American Institute on January 15, the following observations were made. Mr. Newton said: I am satisfied from observation and the investigation I have made that prints made by development from bromide of silver are absolutely permanent. The bromide paper was first made in Europe, and the first prints we have are on imported paper. The keeping qualities of this paper before using, as well as after, is an important question. I have kept samples manufactured by one firm three years and a half without its exhibiting any signs of deterioration. The firm that made this brand assures me that they have it five years old, and it is as good now as when first made. Here is some testimony as to its keeping qualities after printing which it gives me pleasure to be able to present.

Mr. F. C. Beach, of the SCIENTIFIC AMERICAN, writes me as follows: "A bromide enlargement equivalent to a print on gelatino-bromide paper has been in a frame exposed to the light for the past ten years in the rooms of the Society of Amateur Photographers of New York, and the reduced silver image is as bright and brilliant to-day as when the print was first framed, though the white portions have changed slightly from white to a yellowish color, which is regarded as due entirely to the discoloration of the paper support itself, and not to any alteration or fading of the reduced gelatine silver salts. This print was developed with ferrous oxalate and fixed in plain hypo." The evidence is unquestionably in favor of the permanence of these prints.

The ferrous oxalate developer is still recommended by many manufacturers. The trouble I encountered in developing bromide paper by any of the ordinary processes was in controlling the developer, and my labor has mainly been how to construct a developer so that at all times it would be under perfect control, in other words go slow, so slow as at all times to make the danger of over-printing the minimum and no danger of its running away with you. I finally adopted the alkaline in place of the ferrous oxalate developer.

Different alkalies do not produce uniform effects on paper manufactured by different firms. The carbonates produce a browner black than the caustic alkalies. The beauty of the print after all will, to a certain extent, depend upon the bromide in the developer; particularly is the effect noticeable of the addition of bromide of soda to the developer. A variety of tones may be made by modifying the proportions of the ingredients in the formula I am about to give.

In the case of hydroquinone as the principal ingredient of a developer, bicarbonate of soda, borate of soda, and boracic acid act as restraining agents, but in using amidol none have that effect except boracic acid, and that but slightly. Therefore, in introducing these agents, you will understand what office I expect them to perform. The first formula is as follows:

Water	1 ounce.
Sodium sulphite (crystals)	15 grains.
Sodium bromide	2 grains.
Sodium carbonate	5 grains.
Hydroquinone	3 grains.
Metol	1 grain.

If you wish this developer to work slower add either 10 grains bicarbonate of soda or 10 grains of borate of soda or 5 grains of boracic acid to the ounce of developer. This is the best I have yet found with the carbonate alkalies; some may prefer the effect of carbonate of potash; my advice is that you try it.

The caustic alkalies produce blacks which I think are deeper and richer. The simplest form for a developer with caustic alkali is lime water, instead of plain water. Substitute it for the carbonate of soda in the foregoing formula. Another modification is the addition of two grains to the ounce of water, of caustic soda, afterward treated the same as in the first instance. I have made some of my most beautiful prints with barium hydrate. In using this ingredient, use ten grains to an ounce of water, because in the first place only seventy or eighty per cent of the barium salt is soluble, and further when you add the sodium sulphite a percentage of the barium solution is converted into an insoluble barium sulphate which makes the barium developer resemble a cup of milk. It will settle clear however in a short time, but there is not the slightest use in waiting, as the milky appearance has no chemical action on the paper.

Strontium hydrate also will be approximate in its effect to barium in a developer, but I have discovered no special advantage over it.

The simplest of the caustic alkalies seems to me to be lime water, which is water saturated with calcium hydrate. This can be made a commercial article by evaporating it to dryness. To do this so that it will be in the most available form, add four ounces of granulated sugar to a gallon of lime water and then evaporate to dryness. The salt thus obtained can be redissolved to suit when a developer is to be prepared.

All of these developers keep indefinitely. Even if they stand in the graduate several days their developing power seems the same. They rarely change in color. They have harnessed within them sufficient potential energy to keep them at work as long as there is any exposed paper on which they can exert their power. Into any of these developers a dozen or so exposed prints can be put at a time and developed together, much as they are toned at present, so the printing and developing prints by this process will be much less troublesome and consume much less time than the old way. Besides, what is more important, they will be more beautiful and permanent.

An excellent fixing bath for bromide prints is made as follows, the chemicals being dissolved in the order given:

Water	10 grains.
Pulverized alum	100 grains.

When dissolved add—

Sulphate of ammonia	480 grains.
Hyposulphite of soda	2 ounces.

It will keep clear and can be used repeatedly until exhausted. The film is hardened and the whites are remarkably clear and pure.

Some Exhibits at the National Cycle Show in Madison Square Garden.

Any attempt to speak of the various exhibits must involve many sins of omission, on account of the number of things to be seen.

Among the exhibits of wheels, none attracted more attention than that of the Columbia bicycles, shown by the Pope Manufacturing Company, of Hartford, Conn. The Columbia wheel now has the single tube upper brace. Nickel steel tubing is used in all their frames, and a new design of hub, the barrel hub, is used. The crank arms and shaft are in only two parts, which screw by right and left hand screws into a transverse tube, which carries the cones. The two abutting ends of the shaft interlock in the center. The sprocket is detachable, so that the gear can be altered without trouble. The chain is particularly elegant, with alternate links finished in blue and yellow steel tempering colors. A number of weights of wheels are catalogued.

The Remington Arms Company, of this city, have a large exhibit. Their 1895 wheel is changed from the wheel of 1894 in many details. A barrel crank hanger, giving a narrow tread, is substituted for the old type. The rake of the head has been changed and the weight of the machine decreased. The crank arm formerly introduced by this firm has been retained.

E. C. Stearns & Co., of Syracuse, N. Y., have won a reputation for their wheel in the record field, many racing men having chosen it as their mount. Their 1895 wheel has a new detachable sprocket, an adjustable handle bar, dust-proof bearings, and many other features. Among their exhibits are tandem, triplet, and quadruplet wheels of very elegant design.

The Warwick Cycle Manufacturing Company, of Springfield, Mass., have seven regular types of wheels. The parts are so proportioned in the diamond frame wheels as to bring the upper brace and rear lower braces horizontal. The diameter of the tubes of the frame has been increased. The front sprocket is detachable and the handle bars are adjustable. The pedal is particularly ingenious and simple in construction.

The Keating Wheel Company, of Holyoke, Mass., have introduced a number of improvements in their 1895 wheel. The frame tubes are re-enforced, the front sprockets are attached to the crank directly. The center brace of the frame where it joins the crank hanger is bent forward, the idea being to stiffen the frame at this critical point.

The Monarch Cycle Company, of Chicago, use Mannesmann steel tubing in their frames and have a remarkably attractive exhibit. As a matter of display they exhibit two of their wheels in large picture frames with black background and with electric lamps distributed over the machine. The wheels are kept in rotation by an electric motor, and as the colored lamps with which they are decorated blend into a circle of light, the effect is quite striking.

The Western Wheel Works, of Chicago and New York, show a large variety of wheels, varying in price and general specifications. The wheels are termed Crescents. The sprocket is of a new type, being made of boiler steel, stamped cold, and case-hardened. This firm shows some very high grade juvenile wheels also.

The Eagle Manufacturing Company, of Torrington, Conn., have one of the most striking exhibits. Their detachable sprocket is characterized by depending for its strength directly upon the metal, the ends of the sprocket arms dropping into recesses on the outer segments, the screws merely holding the parts together. The tubes of the frame are re-enforced at the ends by short inner tubes over which the ends of the outer tubes are cold-swaged. This gives a tube of reduced diameter at the ends, and results in a most graceful frame. Aluminum rims are used on the regular output, unless wooden rims are desired. The lady's wheel with triple tube loop frame is one of the most distinctive novelties of the exhibition.

The Spalding wheels, made by A. G. Spalding & Bros., of this city and of Chicago, had a very fine exhibit, as had also Gormully & Jeffrey, of Chicago. No wheels stand higher than the product of these firms. The tandem wheels of the Rambler type made by Gormully & Jeffrey were particularly attractive.

The Sterling Works, of Chicago, had an interesting exhibit of their strong, fast, light wheels, said to be "built like a watch;" and the Ames & Frost Co., of Chicago, large and well known manufacturers, who make a wheel second to none in the market, were also well represented.

Among other wheels well known to all lovers of bicycle riding, some of them having a world-wide reputation, and which materially contributed to enhance the value of the exhibition, may be mentioned those shown by the Lovell Arms Co., Boston; the Waverley, of the Indiana Bicycle Co., Indianapolis, Ind.; the Tribune, of the Black Manufacturing Co., Erie, Pa.; and the New Mail, of William Read & Sons, Boston.

Many firms exhibited accessories of the wheel. Among tires may be particularly mentioned the Palmer. As now constructed, this tire is almost self-healing, and by a special repairing outfit can be repaired with the utmost ease if punctured, a mushroom shaped plug being forced into the puncture. The hose pipe tire used on the Columbia wheels was also shown, and for it a very simple and effectual repairing device is supplied, also involving the use of a mushroom patch.

The Cleveland Machine Screw Company showed their steel balls for ball bearings. Under one inch diameter their balls are turned from the solid bar, ground by the Richardson-Grant patent process and hardened.

Cyclometers are shown by the Bridgeport Gun Implement Company and the New York Standard Watch Company among others. The first named firm manufacture also the celebrated Search Light bicycle lamp, which burns kerosene oil. The Standard Company's cyclometer, weighing but 3¼ ounces, has the highest claims for accuracy and durability made for it by the makers.

The Spectrum of Mars.

Prof. W. W. Campbell has lately brought together all the observations of the spectrum of Mars, and discussed them in connection with the *telluric spectrum* and with his own observations made during the past summer. (Publications of the Astronomical Society of the Pacific, vol. vi., No. 37.) He concludes as follows:

(1) The spectra of Mars and the moon, observed under favorable and identical circumstances, seem to be identical in every respect. The atmospheric and aqueous vapor bands which were observed in both spectra appear to be produced wholly by the elements of the earth's atmosphere. The observations, therefore, furnish no evidence whatever of a Martian atmosphere containing aqueous vapor.

(2) The observations do not prove that Mars has no atmosphere similar to our own; but they set a superior limit to the extent of such an atmosphere. Sunlight coming to the earth via Mars passes twice either partially or completely through his atmosphere. If an increase of 25 to 50 per cent in the thickness of our own atmosphere produces an appreciable effect, a possible Martian atmosphere one-fourth as extensive as our own ought to be detected by the method employed.

(3) If Mars has an atmosphere of appreciable extent, its absorptive effect should be noticeable especially at the limb of the planet. Prof. Campbell's observations do not show an increased absorption at the limb. This portion of the investigation greatly strengthens the view that Mars has not an extensive atmosphere.

Palace Trolley Cars.

A palace trolley car which marks the height of luxury and convenience in street car construction has been introduced recently in Boston. The new cars are designed for the use of so-called "trolley parties," and will be run only when especially chartered. It is thought that they will prove very popular for carrying theater parties or parties for other entertainments. The bodies of the cars are 20 feet long by 7 feet 4 inches wide and the motors are 25 horse power each. The outside coloring is in black and gold, with crimson panels, and the trucks and running gear are painted a dark green. The woodwork of the interiors is of polished mahogany and the upholstering is of peacock blue brocaded plush. Each car will be supplied with twenty chairs of an elegant pattern and these are to be supplied with wire hat holders beneath them. The brass finishings, the frescoing and the electrical apparatus are all in keeping with the general elegance of the other furnishings. These cars will also be equipped with electric headlights, which are also a new departure Other palace cars similar in design to the ones described are in course of construction, and are to be run from the suburbs of Boston to the city on Sundays for the comfort and convenience of church-goers.

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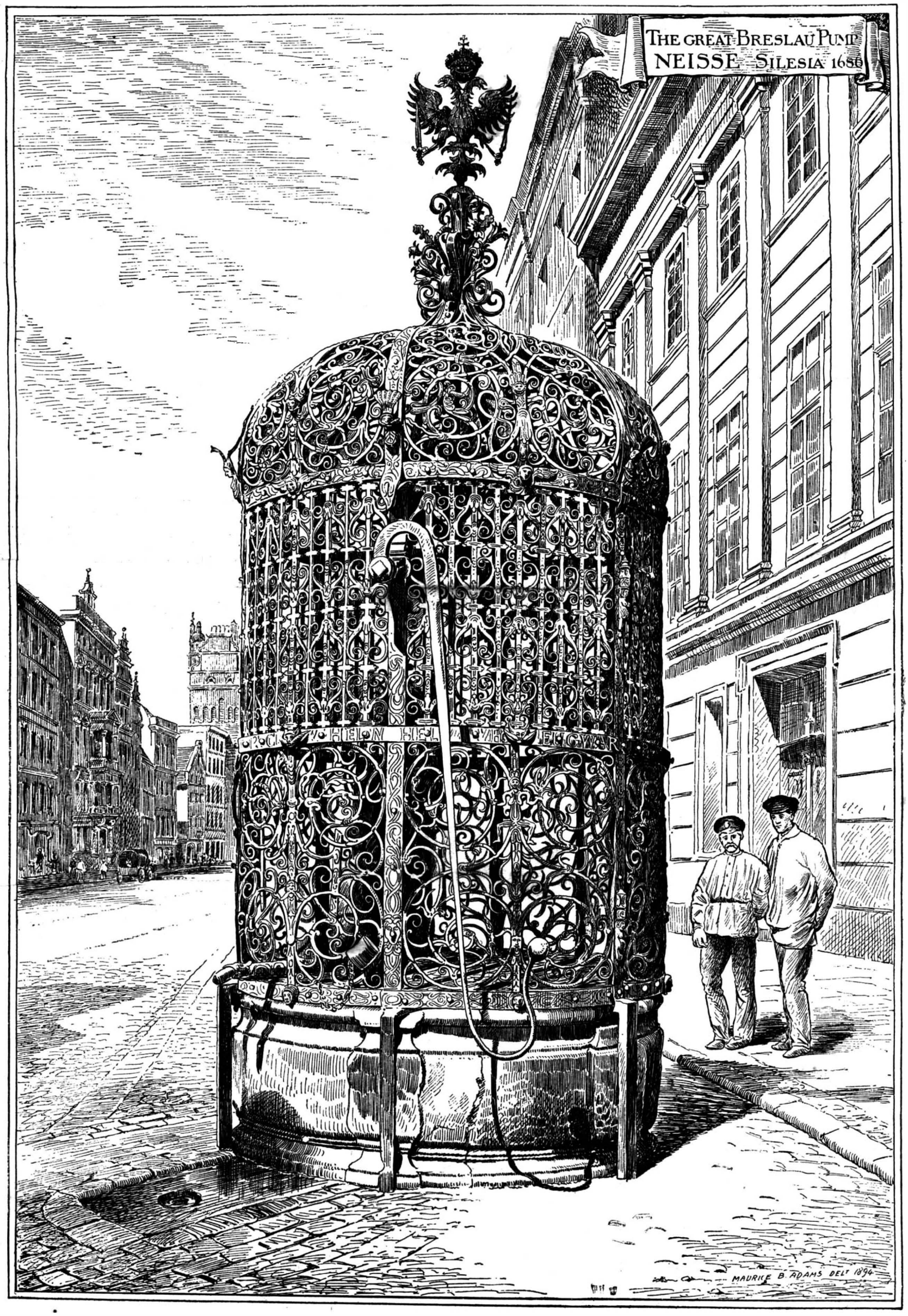
THE GREAT BRESLAU PUMP, NEISSE, SILESIA.

There are few instances of the smith's craft, even in Germany, which will compare with this Silesian pump case, standing in the Breslau Grand Strasse, at Neisse. Although dated late in the seventeenth century, it is a thoroughly traditional piece of work, and in some ways may be said to be even mediæval in the spirit of its design. The quaint freedom adopted by the smith as he introduced the many little grotesque conceits which enliven the foliations of the scroll work exhibit a gayety and delight on the part of the artificer which distinctly adds to the individuality of his production. An inscription is carried round the central band of the structure, just above the level of the head. The imperial eagle, surmounted by a crown, serves as a finial to the composition, and rises in an effective manner over the bunched-up scrolls, into which the inclosing framework of the domical roof lines of the cage are developed. The curves throughout the design are graceful and well distributed, with a due regard to scale.

The drawing which we publish is reproduced from Mr. Ernest Wasmuth's "Denkmaler Deutscher Renaissance," a work of artistic thoroughness and utility to which we have on more than one occasion made favorable references. The base of the pump at Neisse is constructed of stone.—The Building News.



THE GREAT BRESLAU PUMP, NEISSE, SILESIA.

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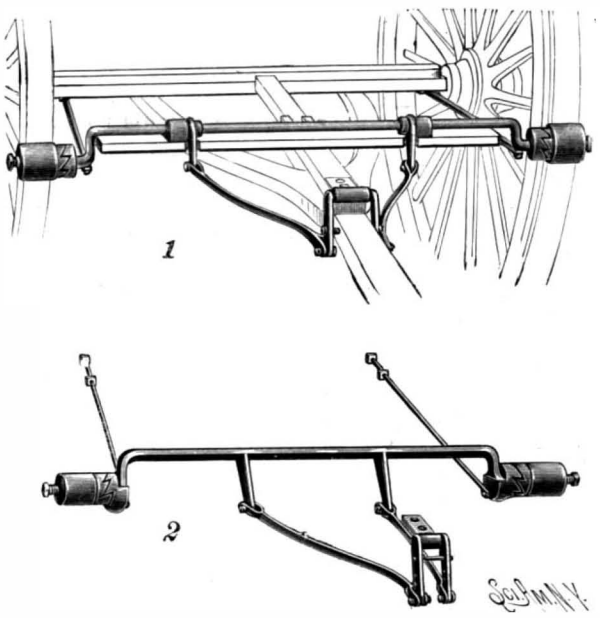
AN AUTOMATIC VEHICLE BRAKE.

This brake, which has been patented by Mr. H. D. Cool, is applied by the team in holding back, as in going down hill, and is so constructed that, without removing the shoes from engagement with the wheels, the vehicle may be as readily backed as if the brake were not applied. Fig. 1 represents the application of



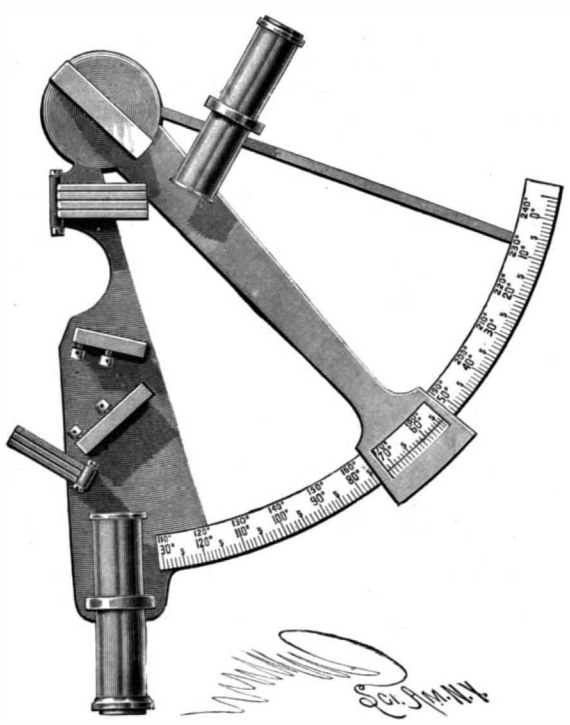
COOL'S VEHICLE BRAKE.

the device, it being shown in Fig. 2 detached from the vehicle. Mounted on or supported from the rear hounds is a rockshaft having at each end a crank arm in front of each rear wheel, and each arm carries a cylindrical shoe made in two sections, both loosely mounted, and having opposing clutch faces. The outer section is constantly held in engagement with the inner one by a spring confined on the crank arm by a cap or stop, and the space between the sections is guarded from dirt by a shield. The movement of the brake to and from the wheel is controlled by rods pivotally connected with the inner sections of the shoes, eccentrically or concentrically, the opposite ends of the rods being attached to an axle. The reach of the vehicle has more or less end movement, and to it it attached a clevis connected by links with crank arms on the rock shaft, the links being adjustably connected that the power with which the brake is applied may be increased or diminished. The holding back on the part of the team, causing a rearward movement of the reach, effects the application of the brake, the inner sections of the shoes being held stationary by the rods projecting from the axle, and by the engagement of the clutch teeth, preventing the revolution to the rearward of the outer sections of the shoes, which are at the same time brought into contact with the periphery of the wheel. As the outer sections of the shoes are, however, free to revolve in the opposite direction, the backing of the vehicle will not be interfered with.

This improvement is being introduced by Mr. Charles G. Locke, of Randolph, N. Y.

A LARGE ANGLE SEXTANT.

The sextant attachments shown in the illustration convert the ordinary sextant into a measur-



FERGUSON'S LARGE ANGLE SEXTANT.

ing instrument for measuring large angles, extending the range of the sextant to the measurement of angles up to 240 degrees. The improvement has been patented by Mr. Thomas T. H. Ferguson, of the imperial Chinese customs service, Peking, China. The instrument is still essentially a sextant, and may be of the most improved and accurate kind, its affixures rendering it capable of spanning the larger arcs without detriment to its accuracy and nicety of adjustment. The same index arm is used, and the same vernier and arc divisions, but the value of the angle is taken from figures engraved above the old figures on the silver arc, additions which can be made to any sextant by a maker of ordinary skill. The engraving shows the arrangement of parts, there being behind the horizon glass another horizon glass in every respect similar, except that it is slightly broader, and it is mounted perpendicularly, being firmly fixed to an extension of the framework, allowing of the usual adjustments around horizontal and vertical axis. Its center is placed on the line which connects the centers of the old horizon and the index glass, and it makes with the old horizon glass an angle of exactly sixty degrees, its back turned toward the back of the old horizon glass. In newly constructed instruments it is better to mount the two horizon glasses on a common base plate to be fixed to the framework of the sextant. The set of dark glasses usually found behind the horizon glass, being moved from their place by the new horizon glass, must be shifted further back on the visual line of the first telescope, as they have now a double function to perform, for when using the second telescope it is advisable to raise those glasses so as to shade off noxious reflections from the back of the first horizon glass. The improvement enables one to measure each angle over 120° twice, first the angle itself and then its supplement. Supposing all parts to be properly adjusted, a mere shifting of the eye from the usual telescope to another fixed at another part of the instrument is all that is needed to use the sextant in its large angle capacity.

The Falls of Niagara.

The Niagara River extends from Lake Erie to Lake Ontario, a distance of 30 miles. It receives the waters of all the upper lakes—Erie, St. Clair, Huron, Michigan, Superior, and a number of smaller ones. From source to outfall it has a total descent of 334 feet, but greater part of the fall occurs within a distance of 7 or 8 miles, beginning with the rapids, 2 miles above the great falls, which received their name—Niagara, meaning the "thunder of waters"—from the aborigines. Their roar, under favorable circumstances, may be heard at a distance of 15 miles.

There are three distinct falls: The Horseshoe Fall—so called from its crescent shape—is by far the largest, and is in the direct course of the river. It is 2,000 feet wide and 154 feet high. The American Fall is 660 feet wide, and the Central Fall 243 feet, each having a fall of 163 feet.

The water flows on perpetually the same, full and clear; neither the snows of winter nor the evaporation of summer, neither rains nor drought materially affect it—excepting that about once in every seven years there is a gradual rise and fall, which is attributed to some undiscovered disturbance that affects Lake Erie.

"Of all the sights on this earth of ours which tourists travel to see," wrote Anthony Trollope, "I am inclined to give the palm to Niagara. In the catalogue of such sights I intend to include all buildings, pictures, statues, and wonders of art made by men's hands, and also all beauties of nature prepared by the Creator for the delight of his creatures. This is a long word; but, as far as my taste and judgment go, it is justified. I know of no other one thing so beautiful, so glorious, and so powerful."

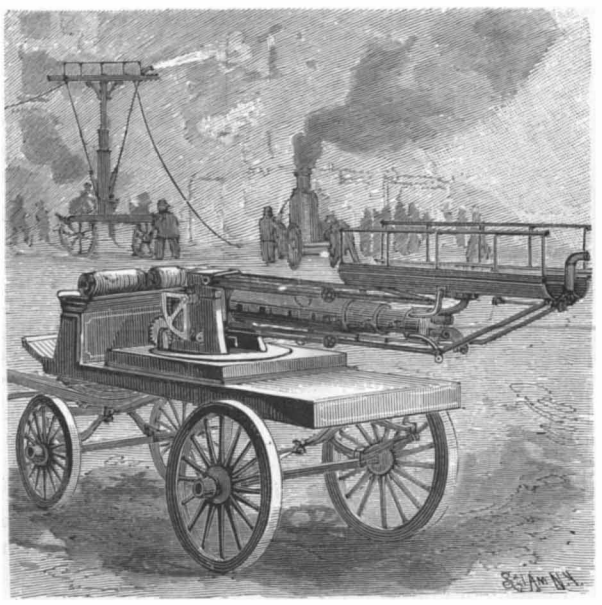
This wonderful cataract is 447 miles from New York, within a single day's journey, and is reached most directly by the New York Central and Hudson River Railway, of which it forms the western terminus.—Dr. A. N. Bell.

Interesting Records of the Wanderings of Derelicts.

In a recent issue we referred to a decision of the Admiralty and Board of Trade of England, which condemned the United States charts referring to the position of derelicts, on the ground that the charts probably exaggerated the danger from this source. The distance which such vessels traverse is, however, much greater than is generally supposed. Such wrecks are sighted from time to time by vessels and their position at the time is recorded, and a careful record of all these observations makes it possible to prepare a chart which, in a general way, will show these wanderings. According to a chart of this kind, recently published, the derelict Fannie E. Wolston has traveled during the past five years somewhat more than 10,000 miles. This calculation is based upon forty-six reports made by various vessels. Another derelict, which started on its wayward course in 1891, drifted about 3,500 miles up to the time it was last seen, or a period of 615 days. Another remarkable derelict, the W. L. White, floated about the North Atlantic for 310 days, covering in that time some 5,910 knots. All these long-lived derelicts have been heavily loaded with lumber and they have, therefore, been able to keep afloat for very long periods. The lumber buoys them up and prevents the storms from crushing them. Derelicts are moved for the most part by the force of various ocean currents. And in general they eventually float to that portion of the North Atlantic known as the Sargasso Sea, where the currents are very sluggish and weak. This region is, fortunately, outside the track of most of the Atlantic commerce. It can readily be seen, however, that in these wanderings the derelicts are likely to prove very dangerous.

A HOSE BRIDGE AND TOWER.

The illustration represents an apparatus for fire departments, which may be collapsed and folded into small compass or extended and raised as required, forming a hose bridge to carry lines of hose over a railway or street. The apparatus is also arranged to discharge water from the bridge without the use of the hose, thus enabling it to be employed as a fire tower, with revoluble nozzle operated from the truck. The improvement has been patented by Messrs. James Blake and Emil F. Begiebing (address E. F. Begiebing, No. 285 Canal Street, New York City). The truck carries a bed plate with circular track supporting rollers on which is a turn table carrying the superstructure, the table being rotated by means of a gear and pinion connection with a crank within easy reach of the driver's seat. On the table are pillow blocks in which are journaled the trunnions of the lower section of the tower, this section having an enlarged casing at its lower ends serving as a housing for the gear at the foot of the tower. The trunnions have toothed segmental racks engaging worms on shafts whose gear wheels engage a driving gear with a crank handle, also near the driver's seat, by which the sections of the tower may be raised to a vertical or turned down to a horizontal position. The lower tower section has



BLAKE AND BEGIEBING'S HOSE BRIDGE AND TOWER.

in its opposite sides anti-friction rollers, enabling the second section to be moved up easily, which is effected by means of a screw whose driving gear is actuated by the turning of a crank, the screw also entering and engaging racks in the third tower section, thus serving to raise both sections. The several sections of the tower have at their upper ends hooks adapted to support ladders, and at the upper end of the top section are brackets for the support of a bridge, so fulcrumed that by removing a pin, the bridge may be swung to lie substantially parallel with the body of the tower. The bridge has hand rails, or guards, and is held rigidly in horizontal position by hinged braces, which are extensible to provide for the varying height of the tower. The apparatus also has telescoping pipes in the tower sections, connecting at the top with a cross pipe to which a hose may be attached, or from which water may be discharged directly upon a fire, the head connected with the pipe having the movement of a universal joint, and being turned by means of pinions and an extensible shaft, with a hand wheel at its lower end, to discharge the water in any desired direction. The apparatus may also be employed as a fire escape.

Wool Scoured with Naphtha.

In a new method of scouring wool, naphtha is employed as the cleansing substance. By means of a pump the naphtha is forced through and through the wool, extracting all the natural oil. It is claimed that the naphtha does not injure the fiber of the wool, as alkali cleansing, but leaves the fleece in better condition than when cleansed by any other process.

A further valuable feature of the new method is that after the grease is extracted from the wool it may be again extracted from the naphtha in a pure state, thereby becoming valuable as a medicinal agent or for a saponification into the purest of soaps. It is claimed that a plant following this method scoured 500,000 pounds of wool, and had saved a product of 80,000 pounds in pure wool oil.

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Science Notes.

Electrolysis of Glass.—A very curious experiment upon the action of currents traversing glass has recently been made by Mr. Stansfield. He placed amalgams of potassium, sodium, and lithium in a balloon and immersed the latter in a bath of mercury kept at a temperature of 200°. The anode of a powerful electric battery was introduced into the balloon, while the cathode dipped in the external mercury. At the end of a few hours, the balloon was taken from the mercury, when the following phenomena were observed: With the amalgam of lithium, the glass had become very fragile and had lost a little of its transparency. The bath of mercury contained sodium.

With the sodium the same phenomenon, but the glass had undergone no alteration.

With the potassium there had been no transfer of metal.

Mr. Roberts-Austen attributes these singular results to the size of the atoms. According to him, the potassium, having too large a molecule, cannot substitute itself for the sodium in the glass for want of space. The lithium, having too small a molecule, replaces the sodium, but separates the constituent molecules and thus diminishes the cohesion. As for the sodium transported by the current, that substitutes itself in the glass for the silicate base without any other modification than a continuous carriage.

Building Materials of Wood Fiber.—According to the Schweizerische Bauzeitung, an inventor has just patented in Switzerland and other countries a new process for the manufacture of objects from wood fiber, such as paving blocks, building materials, etc. The wood fiber is mixed with a suitable agglomerant having mortar as a base. Previous to this, the fiber is impregnated with vitriol, sublimate, etc., to render it antiseptic, after which it is thoroughly dried. The plastic mass obtained through the mixture of wood fiber and mortar is well pulverized and pressed into moulds. As soon as the material has set it is removed from the mould and dried. It is said that the objects thus obtained are light, porous, and tough, and are bad conductors of sound and heat. They can be sawed, nailed, drilled, and otherwise treated, just like wood.

Solder for Glass.—According to the Revue Universelle, an alloy formed of 95 parts of tin and 5 of copper adheres to glass with such tenacity that it may be employed as a solder for connecting tubes end to end. It is obtained by first melting the tin and then adding the copper, the mixture being stirred all the while with a wooden rod. This mixture is run into a mould and melted anew when needed for use. The addition to it of from ½ to 1 per cent of zinc or lead renders it more or less hard.

Artificial Rubber.—According to the Revue de Chimie Industrielle, an artificial rubber of more or less strength may be obtained by dissolving 4 parts of nitrocellulose in 7 parts of bromo-nitro-toluol. Upon varying the proportion of the nitro-cellulose there may be obtained a material possessing elastic properties and much resembling India rubber, and even gutta percha. The bromo-nitro-toluol, says the Revue, may be replaced by nitrocumol and its homologues.

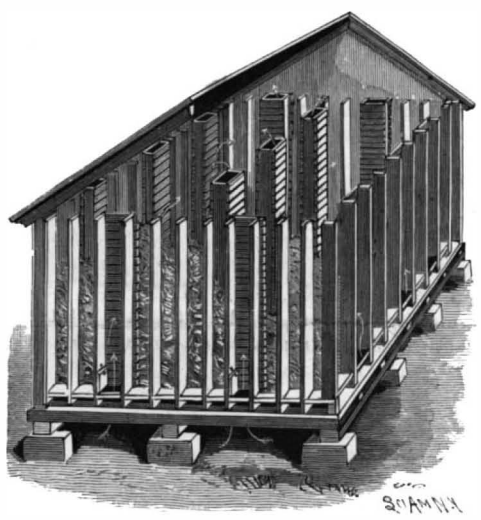
Preservation of Polished Surfaces against Rust.—L'Energie Electrique says that the polished surfaces of steel tools, such as chisels, saw blades, etc., may easily be preserved against rust by the following process. Half an ounce of camphor is dissolved in a quart of melted lard, and the scum which rises and floats on the surface is collected and mixed with sufficient graphite to give it the color of iron. The tools, having first been wiped, are covered with this mixture. At the end of twenty-four hours they are wiped with a soft rag. Thus treated, the tools will remain free from the least spot of rust for several months.

New Process for Hardening Glass.—Since the failure of the Bastie method of tempering and hardening glass, various other processes have been tried which have given more or less satisfactory results. Among these there is one, says the Revue de Chimie Industrielle, which originated in France, and consists in melting hard glass. The crude material, after having been melted in a peculiar style of crucible furnace, is run into moulds, as in casting iron, with the difference that instead of sand there is employed a special substance, and that the mould and the glass are heated and cooled at the same time. To replace the sand a material is selected that has the same conductivity and the same calorific capacity as glass. In this way the glass and the mould form, as it were, a homogeneous mass and the glass can be cooled without crackles, even though the cooling should be effected with relative slowness, this being indispensable whenever it is desired to obtain a hard glass. If care be taken that the surface of the glass do not approach the external envelope of the mould, it makes little difference in what manner the cooling is afterward effected, since the main point is that the mould and the glass shall be brought to the same high temperature, which must be rather greater than that at which glass hardened in a press is usually produced. After the mould has been perfectly heated, it is removed from the furnace and left in the open air, the effect of which is generally rapid enough to produce a proper hardening of the glass. After the whole has become well cooled the mould is opened and the piece removed.

Liquid Cement for Porcelain.—An excellent cement for china and porcelain, says the Revue Scientifique, may be obtained by melting together 75 grains of fish glue and 5 drachms of crystallized acetic acid, and afterward heating the solution until it becomes of a sirupy consistence, so as to form a jelly upon cooling. To use it, the jelly is placed upon a stove, so as to bring it to a liquid state, after which the edges of the broken crockery are coated with it and the pieces strongly compressed.

AN IMPROVED GRAIN BIN.

The illustration represents a bin which may be readily changed from a ventilated bin for ear corn to an inclosed bin for shelled corn, wheat and other grain, protecting the ear corn from the weather and thoroughly drying it by currents of air, and the change being quickly made to adapt the bin for the two uses. The improvement has been patented by Mr. Samuel E. Kurtz, of Mansfield, Ill. The sides and ends of the bin are preferably boarded with drop siding to render them weatherproof, and ventilators are formed in the bin by nailing slats or cribbing on a portion of the side and end studdings, whereby a series of flues is formed at certain distances along the sides and ends of the structure. When further ventilation is desired, or when middle studding is required, as may be necessary in an elevator building or a structure of several stories in height, some of the central studdings are similarly connected in pairs by means of slats, the ventilating flues thus formed each communicating with an opening in the floor, thus permitting a free circulation of air throughout the interior of the largest storage space. When the bin is to be used for shelled corn, oats, wheat, etc., the bottoms of the



KURTZ'S GRAIN BIN.

ventilators are closed by short pieces of boards, the grain then filling the ventilators, or, if desired, wire gauze may be fastened over the slats of the ventilators, whose bottoms may then be left open, and a good circulation of air thus insured through the shelled corn and grain. It is claimed that a storage bin of this construction will last as long as a residence, and may be used with advantage as a shelter or for other purposes when not occupied for storage.

Perfumes—Natural and Artificial.

Almost all the natural perfumes are of vegetable origin, and are derived from treatment of flowers and fruits. In this way are obtained the aromatic essential oils of rose, mint, anise, santal, thyme, cloves, etc., and the perfumes of the violet, iris, and jasmin. Musk is the only important perfume that is of animal origin.

For a long time now, however, the odor of fruits has been imitated with the aldehydes and ethers of fatty acids, such as the acetates, valerianates, benzoates, salicylates, and butyrates of methyl, ethyl, and amyl, which, mixed in definite proportions, recall the odor of strawberries, apples, pears, etc. The following are two examples of such mixtures:

PERFUME OF THE PINEAPPLE.

Chloroform	10	grains.
Aldehyde	10	"
Butyrate of ethyl	50	"
Butyrate of amyl	100	"
Glycerine	30	"
Alcohol, 100 per cent	(liter) 1	

PERFUME OF THE APPLE.

Chloroform	10	grains.
Nitric ether	10	"
Aldehyde	20	"
Acetate of ethyl	10	"
Valerianate of amyl	100	"
Glycerine	40	"
Alcohol, 100 per cent	(liter) 1	

The aroma of rum and cognac and the bouquet of wines have also been reproduced artificially. We shall not dwell upon the danger that accompanies the use of these products in a large quantity when they are mixed with beverages and alimentary substances.

Professor Lowe's Experiences with Balloons.

Professor T. S. C. Lowe, whose successes at Pasadena, Cal., in opening the wonders of Mt. Lowe are now well known, contributes an interesting paper in a recent number of the Mt. Lowe Echo, in which he gives some of his early balloon experiences. We make the following extracts:

The significance I attached to my early balloon work can be better understood if my reader compares and considers it with the "kite flying" of Benjamin Franklin. So much does the modern scientific world think of Benjamin Franklin and his simple kite, that one of the most imposing statues of the World's Columbian Exposition represented him in the act of flying the kite, and it occupied the post of honor at the main entrance of the Electrical building. It seemed a small and insignificant affair, and yet it was that "kite flying folly" that led to the discoveries which have made possible the telegraph, submarine cables, telephone, phonograph, electric lights, electric railways, and the thousand and one scientific and useful instruments and appliances of modern electricity. All these wonderful and useful inventions are the indirect result of that one little experiment of Franklin's, thus demonstrating the value of even small things, when directed for a scientific purpose by a scientific mind.

Few people understand the deep scientific interest that was felt by Joseph Henry and many men of his intellectual stamp in my balloon trip from Cincinnati in April of 1861. The trip was made purely in the interests of science. There was no monetary or other inducement in connection with it. In my observations of air currents I had become absolutely convinced of the existence, in the higher atmosphere, of a current which uniformly and almost invariably moved eastward, with but slight variations, no matter how diverse the surface currents might be. In order to test the existence of this current, over the ocean as well as the land, I planned the exact and necessary machinery to carry on the work, and the trial of it so interested a number of the prominent Eastern bankers and merchants that they offered to help sustain the expense, with a view—provided it was shown to be perfectly safe—to the inauguration of a balloon system which would convey information across the Atlantic in much less time than that occupied by the mail steamers. In those days there was no telegraphic communication between the United States and Europe, the first Atlantic cable having failed, and the only way, therefore, of getting mercantile news across the ocean was by means of the steamers. The merchants knew that the reduction by a day, or even, sometimes, of but two or three hours, in the time of the receipt of important news on business or other affairs would often make a difference to them of many thousands of dollars, enabling them to dispose of, or buy up, goods ahead of their competitors. This was the secret of their willingness to aid in sustaining the expenses of my earlier experiments. I was ready to receive their help, but my object in the work was purely for the interests of science, and to further the organization of the Weather Bureau elsewhere spoken of, and which has since been accomplished on the lines I suggested, by the United States government.

I had already constructed the aerostat for my Atlantic journey. It was the largest one ever built and has never since been approached in size or equipment. With it I safely lifted from the earth, including its own weight, sixteen tons, so that I was thoroughly convinced that I could safely convey across the Atlantic all the materials I required for comfort and safety. Not only was this balloon to carry ample instruments, provisions for the crew, and all the implements, etc., required for observation, and the manipulation of the balloon, but also a full rigged lifeboat schooner with airtight compartments, built of light steel plates.

Chambers's and other encyclopedias state that this balloon would lift 22½ tons. In order that the reader may not misunderstand the apparent discrepancies between their statements and mine given above, permit me to explain that had the balloon been filled with pure hydrogen gas, it would have lifted 22½ tons, but on this occasion I had to use the ordinary coal gas, which, being heavier, permitted me to lift only 16 tons.

Professor Henry, however, was so adverse to my running any risk by making the trip over and across the Atlantic, that he suggested before doing so I should thoroughly test the existence of this current over a long land distance. He advised me to go west with my balloon, make an ascent when the earth currents were blowing strongly to the west, and then, if when reaching the upper currents I sailed across the continent east, the existence of this eastward current, which I claimed did exist, would be sufficiently demonstrated to justify his urging the government to aid me in continuing the experiments, with a view to the organization of the Weather Bureau, to which object I had devoted my attention for so many years.

Acceding to Professor Henry's request, I left my large balloon, and, taking my smaller experimental balloon, went to Cincinnati, and for about a month

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waited for conditions to be exactly as I desired before making the ascent. The newspapers took a great deal of interest in the project, some of them speaking in the most favorable terms of the work. At last the conditions were highly favorable for the experiment, the surface currents moving rapidly westward, and, accordingly, after learning by telegraph that the same conditions existed as far east as Washington, I made the ascent at about 3:30 o'clock of the morning of April 20, 1861. It was fully midnight before I was satisfied as to the existence of these westward-blowing earth currents extending from the Atlantic to Cincinnati, and then, having arranged with the superintendent of the city gas works for the inflation of the balloon, I proceeded at once to direct that important and necessary work.

My readers must here understand that gas, exactly the same as atmosphere, absorbs and holds in suspension in warm weather more moisture than it does when it is cold, so that, the day having been warm and murky, the gas with which the balloon was inflated on this occasion held its full proportion of moisture in suspension.

In ascending I started rapidly toward the west, as the surface currents from the east were quite strong, When I reached an altitude of 7,000 feet I struck the eastward-flowing current, and here very rapidly the thermometer went down to zero. This sudden cold congealed the moisture held in the gas, and formed a fine, glassy, bead-like hail, which in the absolute stillness I could distinctly hear falling upon the silk and rolling down into the neck of the balloon. It being night, it was impossible for me to see it, but under similar circumstances in the daytime, I have seen a miniature snow storm going on inside the balloon when I have left a warm for a cold current of air. It was not a soft snow this time, but, no doubt, owing to the rapid change into so great a difference of temperature, it was a hard, bead-like hail. When the valve was opened to let the expanding gas escape, a bushel or more of this fine hail was discharged.

This caused the balloon to ascend still higher, until, by looking toward a star over the top of the mercury column in the barometer, through a slot I had had arranged for that purpose, and feeling the raised figures—for it was dark and I had made no arrangements for lighting—I found that the balloon was at an elevation of 14,000 feet.

This altitude it retained until sunrise, when the heat of the sun expanded the gas still further, and it rose to the altitude of 18,000 feet.

And such a sunrise!

The horizon appeared always on a level, so that the earth resembled a great hollow bowl, with the exception of the Blue Ridge Mountains, which, owing to their great distance, fully 200 miles, resembled a solitary peak arising from the ocean.

As sunrise approached, the streaks of light rapidly running around the horizon resembled bands of molten gold, and when the sun itself appeared, I was never more astonished and surprised. It was entirely different from our everyday luminary. There was a total absence of its usual dazzling appearance. It resembled a disk of burnished copper, as such a disk would appear when not in the bright rays of any powerful light. This singular appearance was retained during the time of the entire voyage, so long as I remained at an elevation of from 16,000 to 18,000 feet.

This fact proved to me that the dazzling appearance of our great luminary is caused by our atmosphere and the elements it contains, or holds in suspension, within three or four miles of the earth.

The sky, too, was inexpressibly beautiful, even during the daytime, resembling a rich, dark-blue velvet, and the sun, moon and many of the stars were all visible at the same time.

To return now to the point of departure. Mr. Potter, proprietor of the Cincinnati Commercial, and Murat Halsted, the editor, arranged to be with me at the time I decided to make the ascent. They brought down a number of delicacies of all kinds for me to take along, and Mr. Halsted thoughtfully provided me with a large jug of hot coffee, which he wrapped up in a number of blankets in order to keep it hot, which it did throughout the entire journey. He also brought me 200 copies of the Cincinnati Commercial announcing the preparations that had been made for this trip, that the balloon was now being inflated, and that "shortly after going to press Professor Lowe will have left the earth for the purpose of making his long anticipated aerial eastern voyage."

Some of the newspapers amusingly stated after I had ascended that the balloon which had gone up for the purpose of demonstrating the existence of an upper air current which invariably flowed eastward, when last seen, was rapidly sailing west. But when later in the morning at daylight telegraphic dispatches were sent all over the country from Falmouth and Lexington, Ky., saying that a large balloon had been seen rapidly moving eastward, all who saw the dispatches and knew of my discovery were convinced of the correctness of my former deductions.

The average height at which I sailed was about 16,000 feet, but in crossing over the Alleghanies I demonstrated that air currents bound and rebound exactly as the currents of water do. The air was flowing rapidly eastward and as it struck the crests of the Alleghanies it flew up and on, making a great upward curve, into which, of course, my balloon was forced. In a few moments I ascended to a height of 22,000 feet, probably 6,000 feet higher than the balloon could have gone by its own lifting power, and when it made the curve on the other side of the range, I descended so rapidly that the fall was over a mile in less than a minute. Though racing through space with such extreme rapidity, everything around me was perfectly quiet and still—so still, that I could have carried a lighted candle without any protection, and I left loose sheets of paper about without any fear of their being disturbed. The reason for this may not be quite clear to all my readers. I was floating with, as well as in, the undisturbed atmosphere; consequently, there was not the slightest sense of motion whatever. The altimeter, my instrument for measuring latitude and longitude, and thus determining the rate at which I was traveling, showed such a rapid movement of the balloon to the east that I doubted its accuracy, until I glanced down over a rope hanging for 100 feet below the car, and there noticed the short space of time it required to cross large farms, fields, woods, etc. The velocity was so amazing, that I no longer doubted the accuracy of the registrations of my altimeter.

Before reaching the Alleghanies, owing to the flow of a deep and rapid current of air between that range and the Blue Ridge, my balloon was drawn slightly southward, out of the direct eastern path, and I finally landed in South Carolina, a short distance from the line of North Carolina, nearly in a due east direction from Cincinnati.

In crossing Virginia I distinctly heard the cannonading with which the Virginians were celebrating their secession. South Carolina had already gone out of the Union, and the descending of my balloon caused much excitement. It being only eight days after the attack on Fort Sumter, I was considered a Federal spy, arrested and locked up in Columbia jail. Indeed, it was asserted on good authority that I was the first prisoner of war captured by the South during the civil war. Not desiring to be shot as a spy, I sent for the president of the South Carolina College, who explained to the authorities that he was familiar with the purpose of my balloon experiments, which at that time had nothing to do with the army, and at his solicitation I was released. Mayor Boatright, of Columbia, gave me the freedom of the city and a letter bearing the city's seal, asking a safe conduct for me through the Confederate States of North America. As I passed through Tennessee I learned in a peculiar and interesting way that the State had gone out of the Union in secret session. This I communicated to President Lincoln two weeks before it became authentically known in the State.

BALLOON ARMY SERVICE.

Returning to Cincinnati and desirous of accomplishing my Atlantic trip, I was surprised and disappointed to receive a dispatch saying that President Lincoln desired to consult with me in regard to organizing a balloon service for the United States army. Failing to get assistance for my Atlantic enterprise, owing to the unsettled condition of the country, and urged that my own personal desires should be subservient to the wishes of the government, I went to Washington, consulted with the President and military authorities, with the result that the aeronautic corps of the United States army was organized. Just here old methods were found too slow, clumsy and absolutely impracticable for army service. Necessity became the mother of invention, and new devices were quickly developed which have never since been improved upon. Thus the balloon corps began its work, and for the first year of the war was constantly operated on the Potomac, Chesapeake Bay and the James, York and Pamunki Rivers, the balloon being manipulated by means of a barge towed by a tug and guarded by a gunboat.

The balloons were of great service at Yorktown and in all the battles which followed up to the time of Fair Oaks. I am usually asked: "Did the enemy ever fire at the balloon?" I reply: "That was almost a daily occurrence, but having early acquired a fair knowledge of artillery practice, and understanding the calculations that had to be made before so unsteady a mark could possibly be hit, I was enabled, by hiding the base of the balloon operations behind trees or hills, to conceal my distance so that aim could not accurately be made by the gunner." I am often asked if the Confederates used balloons. I would state that they had one in use for a few hours at the commencement of our seven days' battle. Having no aeronauts of experience, they were compelled to inflate it in Richmond and tow it to the scene of action. While it never ascended more than 400 feet, I understand it served them to good purpose while in use. It was afterward stowed away on the Confederate gunboat Teaser, which we captured. The balloon was turned over to me; but finding it of poor material and useless for aeronautic purposes, I cut it up, giving each member of Congress a piece. Their aeronaut evidently thought nothing but silk would answer his purpose, but good cotton would have been much better than the silk they used. Having none of the requisite quality, a convention of ladies was held in Petersburg, of whom 200 each gave a silk dress toward building the balloon. Thinking this might be of special interest, I show you a piece of this historic construction, which, you will observe, represents four patterns of silk dresses.

Thick Fires.

It is the prevailing opinion with some that it is necessary when a boiler is worked to a high rate of capacity to maintain correspondingly heavy fires. It is argued that thin fires are well enough for slow rates of combustion, but as the call for steam increases it must be met by an increased thickness in the bed of coal on the grate. Where heavy fires are carried it is a common thing for the fireman to shovel in all the coal that he can conveniently supply, going so far as to almost fill the opening at the fire door, leaving little if any room for a future supply until that already in has been pushed back to make room for more. The ordinary fireman is apt to favor this method, for the reason that he can introduce large quantities at a firing, and afterward he is not obliged to give the fires much attention for perhaps an hour's time, when he will again fill the furnace full in the same manner as before. This method of firing with most of the high-class bituminous coals in use in the Eastern States requires from time to time the use of the slice bar for breaking up the bed of coal. It has always seemed to the writer that whatever necessity there may be according to the popular idea for carrying heavy fires, in the matter of the amount of labor involved it is in reality more laborious for the fireman than it would be if the fires are kept comparatively thin and small quantities of coal supplied at each firing. As an explanation, however, of the favor which this method receives, it is probable that the class of labor which is generally employed considers the muscular effort required much less of a task than the more frequent and careful attention which is needed when the fires are kept at medium thickness.

As regards a comparison between thick and thin fires, the fact is that more capacity can be obtained from a boiler when a fire of medium thickness is carried and proper attention is given to its condition than can be realized by any system of management when the fires are exceedingly heavy, and advocates of thick fires, who take the ground that they are a necessity when boilers are forced, are entirely mistaken. As to the economy of the two, some persons maintain that heavy fires give the most economical results, but this is questionable. Valuable information on the subject has recently been brought out by the results of two evaporative tests, which we give below. They were made on a 72 inch return tubular boiler having 1,000 3½ inch tubes, 17 feet in length. The heating surface amounted to 1,642 square feet and the grate surface to 36 square feet, the ratio of the two being 45·6 to 1. On the thick fire test the depth of the coal on the grate varied from 8 to 20 inches, being heaviest at the rear end and lightest at the front end. On the thin fire test the depth was maintained uniformly at about 6 inches. The coal was New River semi-bituminous coal. The difference in the results as appears from the figures is an increased evaporation due to thin fires amounting to 15·6 per cent.

Conditions as to thickness of fires.	Thick fires.	Thin fires.
1. Average boiler pressure, pounds	131·6	130·4
2. Average temperature feedwater, degrees.	39·6	43·5
3. Average temperature flue gases, degrees.	484	487
4. Average draught suction, inches	0·17	0·18
5. Per cent moisture steam, per cent	0·25	....
6. Coal per hour per square feet grate, pounds	13·72	12
7. Per cent ashes, clinkers, per cent	5·1	5·7
8. Horse power developed on basis 30 pounds from 100 at 70, horse power.	140·3	144·4
9. Water evaporation per pound coal, pounds	8·517	9·457
10. Equivalent evaporation, per pound of combustible from and at 212 degrees, pounds	10·985	12·234

The Products of Salt Electrolysis.

Some improvements relating to the methods of dealing with the products set free in the electrolysis of salt solutions have been devised by the Compagnie Electro-Chimique de St. Beson. The chlorine and the soda solution being brought together outside the electrolytic apparatus, are employed in the manufacture of hypochlorite of sodium, or else the chlorine being given off is converted into various useful derivatives, while the caustic soda is dealt with separately. In the latter case the soda is mixed with litharge in a digester, mechanically agitated and heated; the hot solution is then carbonated, with the result that insoluble white lead is precipitated, and afterward separated off by means of a filter press. The alkaline liquid is further carbonated for the production of insoluble bicarbonate in solution of sodium chloride, the mother liquor being afterward returned to the electrolyzer.

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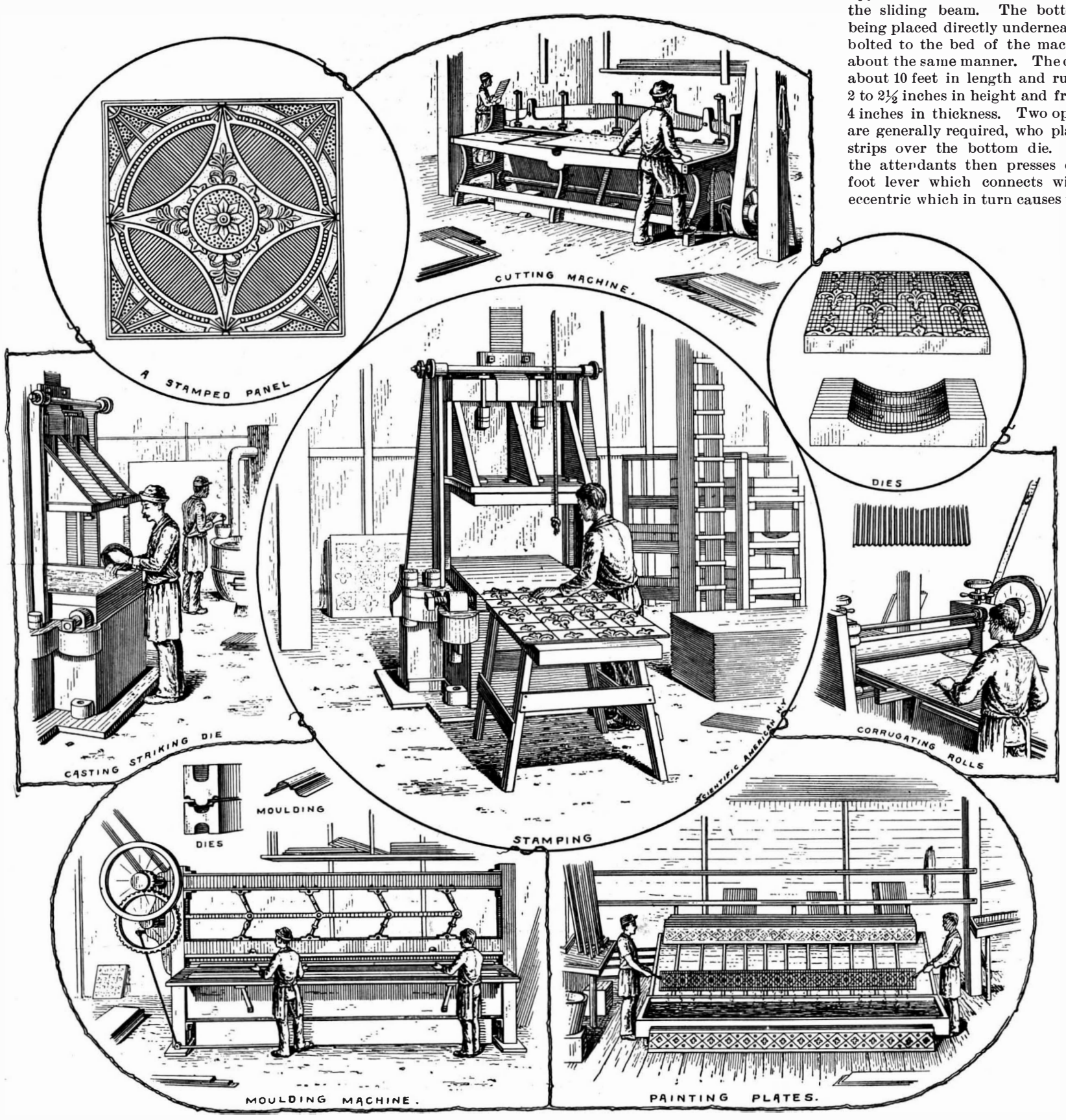
THE METAL CEILING INDUSTRY.

Metal ceilings are manufactured from thin sheets of iron and steel. The sheets are cut into different shapes and sizes and stamped by means of dies into panels, coves, diapers, borders, etc. The material is made up into single squares or plates of almost any size up to 30 inches and also into sheets 10 feet in length. The plates are stamped in such a manner that when the edges are lapped one over the other on the ceiling the joints cannot be seen. In putting up a metal ceiling a number of furred wooden strips or sheathing boards are first nailed to the joists. The patterns or designs, which are of different styles, such as the Greek, Moorish, Louis XVI, etc., are then tacked to these strips by means of wire nails. The strips for these ceilings are made of pine or spruce about 1 inch in thickness and about 2 to 3 inches in width and planed on one side. The strips are nailed to the joists in such a manner the joints of the plates come directly over them. Where using very small plates, the entire surface is generally boarded over. The first operation is the cutting up of the sheets of metal into shapes and sizes. The sheets of iron run in size from 24×120 inches to 30×120 inches. The steel sheets from 20×120 inches to 32½×120 inches in size. In thickness the iron sheets are gauged No. 28 and the steel No. 27. The knife or blade of the cutter is about 10 feet in length and made in two pieces. They are about 4 inches in width and made of ⅝ inch steel. Connected to the machine in front of the blade is a grip, which by means of a spring grips or holds the metal down firmly to the table until after the operator makes the stroke. The sheets weigh about 9 pounds each. About 30 sheets an hour can be cut by a good hand. The plates are then taken from the cutter to the stamping press. The bottom stamping dies are made of steel, ranging in size from 14 inches to 32 inches square and about 3 inches in thickness. They are fastened down securely to the bed of the press by means of four heavy screw bolts at each end. The upper or striking die is made of spelter. This die is formed by placing a wooden frame around the top of the lower or sunken die, which is plastered down on the outside to keep it from shifting. The molten spelter is then poured on the die to the depth of about 3 inches, the metal coming up to the top of the frame. Connected to the hammer of the press are a number of bolts which project down from the bottom at each end about 2 inches, each bolt having a nut screwed on at the lower end. The hammer is then lowered down into the spelter, and left to cool. After cooling about 20 minutes the hammer is raised with the spelter die securely bolted to the bottom. The machine is then ready for stamping. A flat piece of metal is then placed evenly over the sunken design of the bottom die. By drawing back a dog on which the hammer rests, which is worked by the foot of the operator, the hammer falls and the impression is stamped on the sheet of metal.

If a number of impressions are to be made on the same sheet, it is drawn forward, the end of the stamped portion being placed into the impression in the front end of the die. The hammer is then dropped again, the operation being repeated until the whole sheet is stamped. The hammer and spelter die weigh about 2,800 pounds, and have a drop of about 2 feet. The hammer is run by friction and is raised after every stroke by hand. About 500 to 1,000 panels can be stamped per day. After the spelter die is worn out it is removed from the hammer and remelted to be formed into another. After stamping, the plates are taken and dipped into a paint trough.

This trough or tub is made of wood, 10 feet in length, 3 feet in width, and about 8 inches in depth. The tub holds about 70 gallons of cream colored enamel paint made of China clay, oil, etc., into which the plates, borders, etc., are dipped. After dipping they are allowed to drain from five to ten minutes and then taken away and placed in rows on the floor so as not to touch each other until dry. Moulding is formed by means of steel dies, the strip of metal being pressed into shape by a sliding horizontal beam or bed which is drawn up and down by means of four movable knees which are jointed and connected at the center by a horizontal bar or shaft which connects itself to an eccentric. The upper die is bolted to the bottom of the sliding beam. The bottom die being placed directly underneath and bolted to the bed of the machine in about the same manner. The dies are about 10 feet in length and run from 2 to 2½ inches in height and from 1 to 4 inches in thickness. Two operators are generally required, who place the strips over the bottom die. One of the attendants then presses down a foot lever which connects with the eccentric which in turn causes the bar or shaft to draw the knees forward, which forces the beam containing the die downward, causing the sheet of metal to form itself into a strip of moulding. The beam drops about 2 inches. The moulding, if it is to be embossed, then goes to the stamping press to have whatever design wanted stamped into it. The moulding ranges in width from about 1 inch to 7½ inches. The pressure on the moulding is about 200 pounds to the square inch. Coves are also shaped out with steel and spelter dies on the stamping presses in the same manner as the panels. The cove dies are circular in shape and deeper than the others. Corrugated metal plates are formed by running the sheets between two fluted steel rollers 8 inches in diameter and 4 feet in length, which run at the rate of 9 revolutions per minute. The panels, coves, friezes, diapers, etc., are sold by the square foot. Moulding by the running foot. The plates average



THE METAL CEILING INDUSTRY.

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about three-fourths of a pound to the square foot. The plates are given one coat of paint when sold. Two coats of paint are necessary to finish them. The sketches were taken from the plant of the New York Metal Ceiling Company, Ltd., 614 West 21st Street, New York City.

The Life of Our Present Literature.

As far back as May, 1892, says the American Journal of Photography, we called attention to the worthless character of the paper stock, so far as permanency is concerned, that is now used for both photographic as well as printing purposes.

In February, 1893, we supplemented above article by another on "The Adulteration of Paper Stock." In the latter paper we set forth how even the wood pulp was loaded and adulterated with talc and other mineral substances.

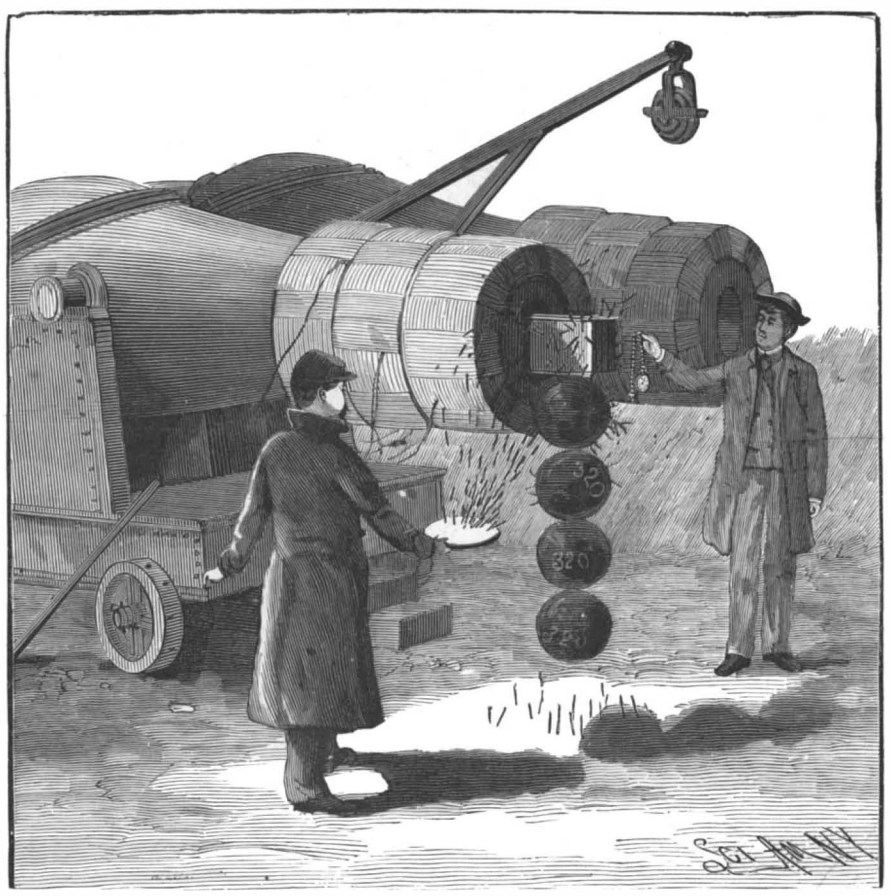
This subject has of late been taken up by noted bibliophiles in Europe as well as in America. The last noted celebrity to write upon the subject is M. Delisle, librarian of the Bibliotheque Nationale of France, who calls attention to the fact that paper is now made of such inferior materials that it will soon rot, and very few of the books now published have chance of a long life. The books of the present day will all have fallen to pieces before the middle of next century. The genuine linen rag paper was really calculated to last, and even the oldest books printed on it, if kept with due care, show very little of the effect of time; but the wood pulp paper now largely used, in the making of which powerful acids have been employed, is so flimsy that the very ink corrodes it, and time alone, with the most careful handling, will bring on rapid decay.

Perhaps from one point of view this is not altogether an unalloyed misfortune. Only remnants of present day literature will survive for the information of future generations, and great national collections, such as that in the British Museum library, formed at great expense, and intended to be complete and permanent, will offer to the literary historian of, say, the twenty-first century, but a heterogeneous mass of rubbish, physical laws thus consigning to oblivion a literature of which but a tithe is intellectually worthy to survive.

The papermaker thus unwittingly assumes the function of the great literary censor of the age. His criticism is mainly destructive, and it is too severe. Without the power of selective appreciation, he condemns to destruction good and bad alike.

CANNON MAGNETS.

We reprint from the SCIENTIFIC AMERICAN an illustration of Col. King's great magnet, made several years ago at Willetts Point fortification. The magnet core consisted of two old Rodman 15 inch guns, weighing 50,000 pounds each. It was turned into a club-footed magnet by the addition of many tons of heavy iron plates. The coil consisted of old torpedo cables 14 miles long, carrying 20 to 25 amperes. The armature consisted of 6 platform plates bolted together. A calculated force of 44,800 pounds was insufficient to tear off the armature, the chain used being broken by the strain. Five cannon balls, of 325 pounds each, were suspended like a chain from the muzzle of the gun. An iron spike placed against the breast of a man standing three or four feet off, with his back to the gun, stood out straight. It required the efforts of two men with a sudden jerk to pull away a 25 pound bar from the gun. The entire mass of iron, including guns, carriages, armature, etc., weighs over 130,000 pounds. At a distance of 71 feet the magnetism of the gun equaled that of the earth, a compass needle being deflected 45 degrees; at a distance of 300 feet it was deflected 3 degrees.



CANNON MAGNETS.

Two Centenarians.

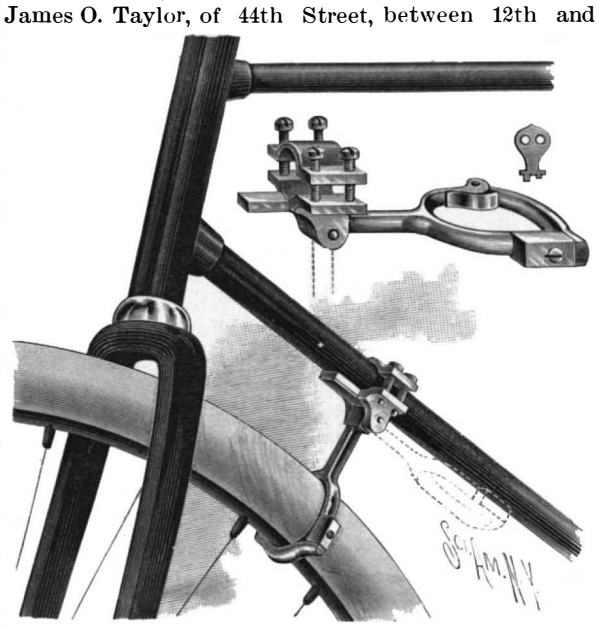
Joseph Shorett, a half-breed, who was born two years before the United States Constitution was adopted, died at Fond du Lac January 16. Shorett was born 110 years ago.

Henry McCaulley, the oldest man in Michigan, died at Battle Creek, Mich., January 17. He was 102 years old and was remarkably active up to the time of his death.

A NEW mode of lighting has been introduced by Mr. Lester Betts, the manager of the Calcutta branch of the Oriental Telephone and Electrical Company, Limited, in the case of the Empress of India Cotton Mills, at Budge-Budge, which are entirely lighted from the outside, special zinc fittings with 50 c. p. lamps being fitted to each window. This system, which has proved a complete success, saves the extra premium for fire insurance.

A BICYCLE HOLDER AND LOCK.

This simple holder and lock is designed to hold the front wheel in position to prevent it from swinging sidewise, and to consequently lock the wheel to the frame. The principal figure in the illustration represents the device in locked position on a bicycle, the dotted lines showing the locking arm thrown up against the frame in unlocked position, and the smaller figure showing the device detached and its key. The improvement has been patented by Mr. James O. Taylor, of 44th Street, between 12th and 14th Avenues, Brooklyn, N. Y. The clamp is readily attached to the bar of the bicycle frame by means of screws, and the locking arm, pivoted in lugs of the clamp, has at its outer end a fork adapted to partially encircle the rim of the wheel, the free ends of the fork being connected with each other by a pivoted spring lockbar, which, when locked in closed position, can only be opened by a key. Adjacent to the pivotal point of the locking arm is a spring which holds the arm in unlocked position up against the under side of the frame, as shown in the dotted lines. The device is small and light enough to be conveniently carried in the pocket if desired, and affords a most effective means of preventing the use of a wheel by unauthorized persons.



TAYLOR'S BICYCLE HOLDER AND LOCK.

The Coloring of Soap and Candles.

The problem of giving soaps and candles a beautiful color, at a low extra cost, has become quite an important one at the present day, the consumer in general giving preference to the colored goods.

The solution of this task, which is now a familiar one to the manufacturers of soap, and especially of toilet soaps, is a much more difficult one to the candle maker; for while in colored soaps the requirements are limited to a beautiful color that will remain unchanged on exposure and not cause stains in washing, candles make the additional demand that the color must not interfere with the burning of the candle.

The latter point adds a material difficulty to the coloring of stearine and wax candles.

Regarding soap, the first point to be observed is to select the proper shade of the flower corresponding with the perfume used; for instance, an almond soap is left white, rose soap is colored pink or red, mignonette green, etc.

The colors from which the soapmaker may select are exceedingly numerous, for not only are most of the aniline colors adapted for his purpose, but also a very great number of mineral colors. Until a comparatively recent time the latter were probably exclusively employed, but the advance in the tar color industry in later years has brought about a not inconsiderable change in this respect. A very prominent advantage of the mineral colors is their stability, i. e., not being changed or in any way affected on the exposure to light. This advantage, however, is offset in many cases by the wonderfully beautiful effect of numerous aniline colors, and by the more difficult method of application in the case of the former. The specific gravity of mineral colors being rather high in most cases, they will naturally tend to settle toward the bottom, necessitating crutching of the soap until it is too thick to drop the color. For mottled soap, however, cinnabar (vermilion) and ultramarine are still largely employed.

For transparent soap, of course, mineral colors are not applicable, as they would detract from their transparency; for milled soap, on the other hand, they are very well adapted, as also for cold made soaps which require crutching anyway until a sufficient consistency is obtained to keep the coloring material suspended.

A notable disadvantage in the use of aniline colors, besides their sensitiveness to the action of light, is the fact that a majority of them is affected and partly destroyed by the action of alkali. A few of them are proof against a small excess of lye, and these may be used with a good effect. Certain firms have made a specialty of manufacturing colors answering the peculiar requirements of soap and being very easy of application, as they are simply dissolved in boiling water and stirring the solution into the soap. To some colors a little weak lye is added; others are mixed with a little oil before they are added to the soap.

For a soluble red color there were formerly used alkanet and cochineal; at present they have been displaced to a great extent, on account of their high cost, by "fuchsin," which is very cheap and of remarkable beauty. A very small amount of it suffices for an intense color, nor is a large proportion desirable, as the soap would then stain. Very delicate tints are also produced by the phthalein colors, of which those named rosbengal, rhodamin, and eosin are most commonly used. These colors, when dissolved, have a green fluorescence which heightens their beautiful effect.

There are also a number of the azo dyes which are suitable for soaps, and these, as well as the phthalein colors, are used principally for transparent soaps. For opaque soaps both aniline and mineral reds are used, among the latter being cinnabar, chrome red, and iron oxide. Chrome red is a basic chromate of lead which is now much used in place of vermilion, but as it becomes black on exposure to an atmosphere containing even traces only of sulphureted hydrogen, it is not especially adapted for soap. Cinnabar gives a bright color, but it is high in price. Iron oxide, known in the trade as colcothar, caput mortuum, etc., is only used for cheap soaps.

For yellow there are also a considerable number of colors. Among the natural colors these are prominent: Saffron, orlean, curcuma (turmeric), and caramel (sugar color); the first named of these is now hardly used, owing to its high cost. Of the yellow aniline colors, special mention is due to picric acid (trinitrophenol), martius yellow, napththol yellow, the yellow azo dyes, and auramin. If it is an orange that is wanted, a trace of fuchsin (red) may be added to the yellow colors named. The use of some unbleached palm oil with the stock answers a similar purpose, but the color fades on exposure. A mineral yellow is chrome yellow (chromate of lead), which has the same advantages and disadvantages as chrome red.

ACCORDING to the American Shipbuilder, the large shipbuilders, Harland & Wolff, Belfast, Ireland, who built the Majestic and Teutonic, pay riveters $7.54 per week; pattern makers, $8.27 per week; platers the same, and fitters $6.57 to $8. More than twice these sums are paid in this country to the same trades, and it is no wonder that merchant ships are built abroad instead of this country, with such a wide discrepancy in the cost for labor.

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Correspondence.

Striking Fire from Pyrite in Coal.

To the Editor of the SCIENTIFIC AMERICAN:

To-day, while breaking a lump of coal in my coal house, there was a very vivid spark of fire and a strong smell of sulphur. Did not appear to be anything in the coal that would make clinker. I was using a steel hammer.

Now there must have been some flint in that lump of coal, and if this is not an unusual state for coal, might not the striking of fire from coal be the cause of explosions in coal mines, as it is sometimes that no reason can be given, but it is blamed to the coal miner, when he is in some cases, if not the most of them, blameless. This, it seems to me, is a new cause of danger that cannot be guarded against. The question is, How did the flint get there? It was in the coal, I am pretty sure.

Quincy, Ill. JOHN L. MOORE, J. P.

[Your hammer undoubtedly struck a piece of iron pyrites. Sometimes this mineral will act like flint in producing a spark. It is possible that explosions in mines have been caused by such cause.—ED.]

Medical Lake.

To the Editor of the SCIENTIFIC AMERICAN:

On page 361 of your issue of December 8, 1894, an article speaking of Medical Lake in the State of Washington and the Dead Sea in Palestine refers to them as being exactly alike, to wit: that no vegetation grows on the borders of either. Having but a hazy recollection of the latter, but being under the impression that I had taken a traveler's lunch on the shore of the former (some thirteen years ago), shaded by trees whose branches were overhanging Medical Lake, I set up an inquiry at once, and beg to present to your readers the following facts: That vegetation grows near the shore of either, but as soon as anything touches the water it is doomed to die. The Dead Sea, which at some places is almost 2,600 feet deep, is almost entirely surrounded by a barren and desolate country, such as will be found in our great desert countries in the far West, but at some places vegetation of all sorts thrives in close proximity of the sea, and there is a legend among the aborigines that at one time grapes were successfully raised on the borders of the Dead Sea.

Medical Lake, in Washington, is in a fine, slightly undulating country. Truly it is sparsely settled with trees, but on the very borders of said lake pine trees are thriving well, and the branches even overhang the water, but let them touch it, and those particular branches are doomed to death. Fine fruits and vegetables of all kinds suitable to the climate are growing in the immediate vicinity of Medical Lake.

Moreover, your article gives the geographical position of Medical Lake as being in the southern part of Washington, while it is almost in the very center of that State on its eastern border, and if your readers will look for Spokane County, they will find Medical Lake some thirty miles from the State line of Idaho, and if anything, a trifle nearer the northern than the southern line of the State, Stevens County, or the Colville country, as old settlers still call it, being the only county north of Spokane, while Whitman and Garfield Counties are immediately south of it.

F. HAGEMANN.

Brooklyn, January, 1895.

Raising Wrecks and Sunken Vessels.

At a recent meeting of the Institute of Marine Engineers, held in London December 10, a paper by Mr. T. W. Wailes on "Raising Wrecks and Sunken Vessels" was read.

Mr. Wailes, in his paper, dealt more particularly with two systems of salving stranded or sunken vessels, viz., lifting with lighters and pontoons, and lifting by platforming. He described in detail the practical working and advantages of each method, and pointed out the precautions necessary to be observed. Alluding to the use of casks for raising wrecks, he said that such things might do for raising small ketches, etc., in rivers and calm waters; but to attempt to raise a large vessel in an angry sea with their use was a most dangerous operation, and should not be attempted. In a case of this kind the work had to be performed between tides, and the casks could not be got in quick enough; with every rise of tide those that might be placed in were floated, the uppermost casks were pressed up inside against the deck and broken. When nearly a sufficient number were got in, the vessel might begin to get lively and knock her bottom out. And as there might be no means of scuttling the ship in an operation of this kind, she might be totally lost in a very short time. Those who undertook the raising of wrecks took upon themselves a great responsibility which required their utmost attention, with a will to face all sorts and conditions of weather and laborious work day and night. And without a constitution for this class of work, the aspirant had better rest at home.

A WONDERFUL PHOTOGRAPHIC NEBULA.

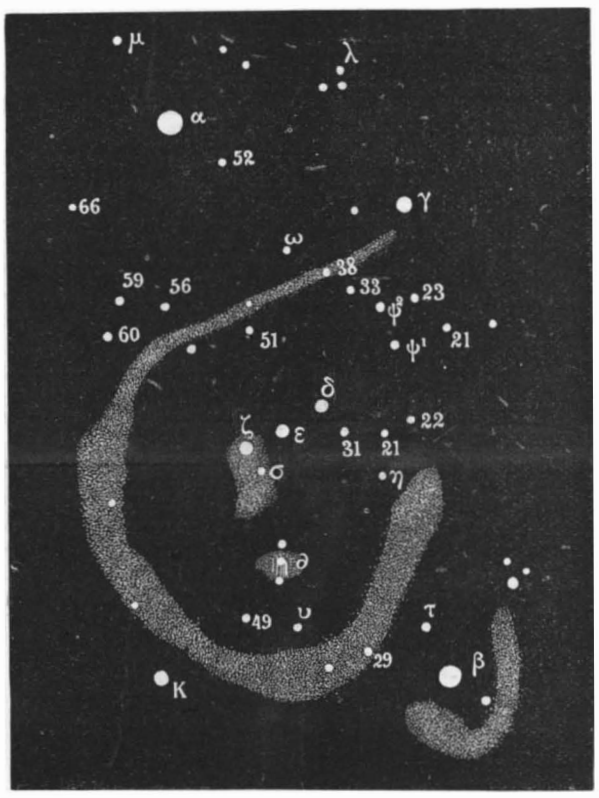
Dr. E. E. Barnard, of the Lick Observatory, gives in the December number of Astronomy and Astro-physics an interesting account of his efforts in taking pictures of the great photographic nebula of Orion. He also presents a drawing from one of the photographs of this nebula, which we have attempted here to reproduce on a black background. It shows the principal stars in the constellation of Orion; but our picture, we fear, will convey a somewhat erroneous impression, as it lacks the delicate details of Dr. Barnard's drawing. This great nebula, as we understand, is not visible to the eye, even in the largest telescopes; its existence is only made apparent upon the photographic plate by long exposure. A small short focus lens is sufficient. Dr. Barnard says the lens he used (which he calls the "lantern lens") "belongs to a cheap (oil) projecting lantern and is 1½ inches diameter and 3½ inches focus (from the rear lens). It gives a field of about 30°, only one-half of which, however, is at all flat—but on this portion the stars are fairly good. The scale is about 10·3° to the inch.

"The ratio of the aperture to the focal length is 1:2·3 while that of the Willard lens is 1:5.

"This large light ratio makes the lens very suitable for certain work where the smallness of the scale is not objectionable—or is really desired—such for instance as very large diffused nebulosities, large comets, the Milky Way, etc.

"The most interesting of the lantern lens pictures are two of the constellation of Orion (for it takes in nearly the entire constellation).

"These were made 1894, October 3 and October 24,



THE GREAT PHOTOGRAPHIC NEBULA OF ORION.

with 2 hours and 1 hour 15 minutes' exposure, respectively.

"To my surprise," says Dr. Barnard, "these pictures showed an enormous curved nebulosity encircling the belt and the great nebula, and covering a large portion of the body of the giant. A description of this nebula would not only be complicated, but it would fail, also, to give any impression of its form and magnitude; I have, therefore, made the inclosed drawing of it, which will show at once its exact location and form.

"After I had made this drawing and partly written this paper, I remembered having seen somewhere that Professor W. H. Pickering had once spoken of a great nebula shown on his photographs of Orion and previously unknown. I have looked up his paper on the subject and find it in the Sidereal Messenger for January, 1890 (vol. 9, p. 2). I will quote here what Professor Pickering has to say concerning this remarkable object:

"'An interesting structure brought out upon our plates is a large spiral nebula whose outer extremity starts in the vicinity of γ Orionis. It passes about four degrees north of ζ, extends to γ, thence to β, then north to η, with an outside stream lying nearly north and south, and preceding β about four degrees. Another stream lying nearly east and west precedes η about the same amount. This nebula is about seventeen degrees in length by nearly the same in breadth, and surrounds a cluster of bright stars, including the belt and sword handle, and extending toward γ. The region containing the nebula is noticeably lacking in stars brighter than the eighth magnitude, but contains the very bright stars γ and β. It is possible that a plate with double our present exposures, which we are soon going to try, will fill the space between η and ζ, thus making the great nebula the inner termination of the spiral. This nebula is shown by three different exposures and is very distinctly marked.'

"Professor Pickering's photographs were made at Wilson's Peak in southern California (altitude 6,250 feet) with a Voightlander portrait lens of 2·6 inches aperture and 8·6 inches equivalent focus, with an exposure of three hours. Stars from the 11th to the 12th magnitude were well shown.

"In the present pictures the shorter exposure shows the nebula best; this was perhaps due to a darker sky.

"The nebula is brightest near 56 and 60 Orionis. Its extreme diameter is about 14° or 15°. Compared with this enormous nebula the old θ, or so-called 'great nebula,' is but a pygmy.

"That this object shown on my plates is the same photographed by Professor Pickering in 1889 there is no doubt, as will readily be seen upon comparing his description with my drawing. The present photographs, therefore, fully confirm the pictures of 1889. This confirmation is all the more valuable as it was unconsciously and independently made."

Value of Our Cereal Crops.

The report of the statistician of the Agricultural Department concerning the area, product and value of the cereal crops for 1894, which has recently been published, contains some very significant figures. The report states that the corn crop of the year is one of the lowest on record, the yield per acre being but 19·4 bushels. The area harvested in the corn-producing States has been reduced by severe drought and dry winds to 62,582,000 acres from the 76,000,000 acres planted. The crop has been about 1,212,770,000 bushels, and the estimated value is fixed at $354,719,000. The wheat crop is slightly above the average. The entire product of the country is 460,267,416 bushels, which is valued at $225,902,025. This represents the entire product of 34,882,436 acres. The rate of yield has been 13·2 bushels per acre, and the average value per bushel 49·1 cents. The estimates of the area, product and value of the other crops are as follows:

The estimates for oats are: Area, 27,023,553 acres; product, 662,086,928 bushels; value, $214,816,920; yield per acre, 24·5 bushels.

Rye—Area, 1,944,780 acres; product, 26,727,615 bushels; value, $13,394,476.

Barley — Area, 3,170,602 acres; product, 61,400,463 bushels; value, $27,134,127.

Buckwheat—Area, 789,232 acres; product, 12,668,200 bushels; value, $7,040,238.

Potatoes—Area, 2,737,973 acres; product, 170,787,338 bushels; value, $91,526,787.

Hay—Area, 48,321,272 acres; product, 54,874,408 tons; value, $468,578,321.

Tobacco—Area, 523,103 acres; product, 406,678,385 pounds; value, $27,760,739.

The Search for Wheelman Lenz.

Mr. Robert Bruce has resigned from the editorial staff of the Bicycling World and has accepted the mission from the Outing Magazine to go in search of his friend Lenz, who it is feared has perished at some point in Asiatic Turkey. The readers of the World are cognizant of the facts surrounding the mystery of Lenz's disappearance. He has been traced as far as the Turkish frontier; the last heard from him was a letter dated Tabreez, Persia, May 3, at which point he was attacked by illness. Dispatches from several points have since announced that Lenz reached Bayazid and was seen in the region of Mt. Ararat. This was the last that has ever been heard of him, Investigation has been made both by the British and American authorities, and Thos. Cook & Sons' resources have been brought into requisition, but all this has been without avail. It now remains to organize a regular expedition to settle the question forever as to the whereabouts of the missing man, and on the shoulders of Robert Bruce the responsibility of heading the expedition falls. Everything that money and experience can obtain will be placed at the disposal of the young man, and no better or fitter leader could be found than the one who has been chosen for that honor. Mr. Bruce's connection with and knowledge of Mr. Lenz are such as to fit him peculiarly for this position. His personal knowledge of Lenz is of the most intimate kind.

Fast Living.

The most remarkable instance of rapid growth is said to be recorded by the French Academy in 1729. It was a boy six years of age, 5 feet 6 inches in height. At the age of five his voice changed, at six his beard had grown, and he appeared a man of thirty. He possessed great physical strength, and could easily lift to his shoulders and carry bags of grain weighing two hundred pounds. His decline was as rapid as his growth. At eight his hair and beard were gray; at ten he tottered in his walk, his teeth fell out, and his hands became palsied; at twelve he died with every outward sign of extreme old age.—Times and Register.

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CACTUS DAHLIA, MRS. FRANCIS FELL.

As the result of the increased attention that raisers have of late years devoted to cactus dahlias a considerable number of varieties belonging to the section were submitted to public notice during the past season. As our reports of the several exhibitions and meetings will have shown, a large proportion of the novelties were so highly meritorious as to greatly enhance the value of the group of which Juarezi is the type for the creation of bold effects at the late summer and early autumn exhibitions and for supplying blooms for indoor decorations. Chief among the novelties of the first class was Mrs. Francis Fell, of which a characteristic illustration is given, an exquisitely beautiful variety, introduced by Mr. T. S. Ware, of the Hale Farm Nurseries, Tottenham, who has done so much to enrich our gardens with cactus, decorative and single dahlias. The blooms, as shown in the illustration, are about 6½ inches in diameter, have long, slightly twisted florets with revolute margins, are quite full, and of snowy whiteness. They are, it may be added, borne on stiff, erect stalks, of sufficient length to admit of their being readily used for decorations of all descriptions. The variety has a free branching habit, is profuse in flowering, and is equally useful for the embellishment of the garden and for the supply of blooms for decorations, and has the promise of becoming popular for market culture. When submitted to the Floral Committee of the Royal Horticultural Society at Chiswick, in September, Mrs. Francis Fell received an award of merit, the highest distinction conferred upon florists' flowers.—The Gardeners' Magazine.

CACTUS DAHLIA, MRS. FRANCIS FELL.

Remedy for Diphtheria.

It is reported that Professor Loffler, of Greifswald, the discoverer of the diphtheria bacillus, has suggested a new remedy for the disease. The mixture recommended is said to consist of alcohol, 60 per cent; toluol, 36; and solution of ferric chloride, 4. Menthol is added to deaden the pain caused by the application, which is effected by means of pieces of wadding, the affected parts being at first treated every three or four hours. Of seventy-one patients treated by this method from the outset, all have been saved, while only one death occurred out of twenty-six cases treated after the second day of the attack.

MANY farmers are in the habit of giving their cows hot water for their drink in cold weather, claiming that they yield one-third more milk than when given cold water. Care should be taken not to give the water so hot as to burn the cows' throats.

Blast Furnaces in the United States.

The number of blast furnaces in activity in the United States at the commencement of November, 1894, was 181, their aggregate weekly productive capacity being 158,866 tons. The corresponding number of furnaces in operation at the commencement of August, 1894, was 135, their aggregate weekly productive capacity being 115,356 tons. At the commencement of May, 1894, there were 127 furnaces in operation, their aggregate weekly productive capacity being 110,210 tons; at the commencement of February, 1894, 125 furnaces, with an aggregate weekly productive capacity of 99,242 tons; at the commencement of November 1893, 117 furnaces, with an aggregate weekly productive capacity of 80,070 tons; at the commencement of August, 1893, 169 furnaces, with an aggregate weekly productive capacity of 107,042 tons; at the commencement of May, 1893, 251 furnaces, with an aggregate weekly productive capacity of 181,551 tons; at the commencement of February, 1893, 251 furnaces, with an aggregate weekly productive capacity of 171,201 tons; and at the commencement of November, 1892, 244 furnaces, with an aggregate weekly productive capacity of 171,082 tons. It will be seen that, after a period of severe depression, the production has nearly regained the level at which it stood two years since.

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RECENTLY PATENTED INVENTIONS.

Engineering.

BLOWER OR PUMP.—Charles Rumley, Helena, Montana. This machine, to be used for either of the purposes named, has a nearly cylindrical case, with inlet and discharge ports and a side offset, a piston rotating in the case, with a valve arm journaled in the offset and pivoted to the piston, while a valvular extension on the arm extends into the offset and to one side of the discharge port. The invention is an improvement on a former patented invention of the same inventor, whereby the parts are so arranged as to prevent possible leakage, and the back pressure will be largely removed from the piston.

AIR CUT-OFF FOR FURNACES.—Robert D. Rhodes and Ludwig Kloz, Leadvillé, Col. A mechanism to control the air blast into the interior of the furnace has been devised by these inventors, to work in such manner that the air for oxidizing sulphur in ores or furnace products may be distributed into the mass to be calcined or roasted from the periphery of the revolving furnace, and will reach only those sections where the air is required. The improvement is more especially designed for revolving roasting furnaces having perforated pipes or flues in their interior to force blasts of air into the ore or furnace products undergoing treatment.

BOILER AND METALLURGICAL FURNACE.—James W. McGranahan, Harrison, N. J. The grate is, with this construction, at some distance from where the heat is applied, and the stream of gas produced is led through flues to the fire box or bed of the furnace, where a clear gas fire is maintained, without ashes or dirt, the air supply being conducted through flues or heaters contiguous to the smoke and gas flues, the walls of the air flues thus becoming highly heated, and correspondingly heating the air supplied for combustion. The grate may be of the ordinary type, or such as used in Siemens furnaces, producing a quantity of incompletely burned gases.

Railway Appliances.

CAR FENDER —Edward K. Thoden, Brooklyn, N. Y. This is a foldable, downwardly spring-pressed catcher frame, projecting from a hanger frame, readily transferred from one end of the car to the other, the fender, when released by the driver, having enforced contact with the track rails, adapting it to catch a person struck by its elastic front edge portion. The guard rim of the fender, when struck by a falling body, is automatically elevated to prevent the person from falling off and hold up the limbs so that they will not drag on the roadbed.

CAR FENDER.—Andrew Mohn and August J. Bothur, Hoboken, N. J. This device consists of a brush held under each end of the car, and of a diameter to cover the roadway to the outer side of each rail, the brushes to be revolved by a mechanism connected with one of the car axles or by an electric motor. The axle of the brush may be connected or disconnected, by means of a clutch mechanism, with the power which rotates it, on moving a shifting lever, the brush being also moved down close to the track as desired, its revolution removing persons from the track without liability to serious injury.

SWITCH. —James Joyce, De Lamar, Idaho. This invention relates to switches operated by a moving train, and provides a working mechanism applicable to a two-way, three-way, or any ordinary switch, with means for throwing the switch by a passing train. Contact rails are arranged to be struck by mechanism on the car, working the switch in series so that they will be struck successively without severe shock, there being also contact wheels and operating mechanism on the car, whereby the wheels may be brought into contact with any desired series of contact rails on the track. The switch may also be thrown by hand as well as the ordinary switch.

SWITCH OPERATING DEVICE. — William Dryden, Brooklyn, N. Y. This improvement comprises a mechanism especially adapted for street railway cars, whereby the switch may be shifted in advance of a moving car, the operator on the platform throwing the shifting device into engagement with the switch points. A shoe pivotally connected with the car is adapted to engage one of the switch points, a spring normally holding up the shoe, which may be depressed by a screw shaft carried by the car, and there being a belt connection between the screw shaft and a hand shaft.

CAR COUPLING.—Charles D. Curry, Denison, Texas. This is an improvement in couplings of the side latching or Janney type, and which are arranged to be uncoupled from the side of the car. The recessed drawhead is channeled on one side and a latch-block pivoted in the recess, while a vertically sliding locking pin is recessed in its side, a detent hook with lateral arm being adapted to rock in the channel to engage the hook with the recess in the pin. The parts when partially detached are supported by other parts of the coupling, and thus prevented from falling on the track.

Electrical.

TROLLEY CATCHER. — Martin V. B. Nichols and James A. Fraser, Port Arthur, Canada. A guideway in which slides a weight is held on the car, according to this invention, the weight being flexibly connected with the trolley pole, and held elevated by a detent which is released by the upward movement of the trolley arm, automatically preventing it from flying up when disengaged from the trolley wire. The attachment is simple and inexpensive, can be quickly adjusted by the motorman to reset the wheel against the wire, and serves to pull the trolley arm down from the wire and supports as the wheel jumps therefrom.

Mechanical.

MOULD FORMING MACHINE. — Louis His, New York City. For forming and shaping moulds for castings, especially for preparing moulds for casting propellers, this inventor has devised an apparatus which is perfectly adjustable either vertically or laterally, and is provided with a rotary knife or cutter head adapted to accurately form the mould, the cutter head being under perfect control while in motion, so that it may be given any desired pitch. The flask, with properly tamped sand, is placed beneath the cutter head, the latter being moved into contact by adjusting screws, and by its revolution scooping out the sand, the pitch, the height, and the longitudinal direction of the cutter head being readily changed and controlled as the operation proceeds.

Agricultural.

TRANSPLANTER.—Otto F. Mulhaupt, Shreveport, La. This is a box-like structure of very thin wood, designed to quickly decay, and with its sides and bottom having numerous apertures through which the roots of the plant may reach the surrounding ground and receive moisture. The bottom slides in side slots and may be removed if desired, the transplanter affording a perishable receptacle in which small plants may be raised from the seed and transferred to the ground without removing the earth from around the roots and disturbing the growth of the plant.

Miscellaneous.

NEWSPAPER WRAPPING MACHINE.—James T. McColgan, Nashville, Tenn. According to this improvement a presser cylinder is mounted to rotate in conjunction with an intermittently revolving core, the cylinder swinging toward and from the core, while a feed table guides the paper and wrapper between them, there being also a cutting mechanism, a paste supply roller, and a swinging frame carrying them both to move the roller in contact with the wrapping paper. Address pasters may be attached to the wrappers before or after wrapping, the machine being designed to automatically wrap newspapers and other publications for mailing in a most efficient manner.

DOOR LOCK ATTACHMENT.—Waldo G. Rex, Shelton, Washington. According to this invention certain devices are applied to the inner keyhole face plate of the door and to the interior of the lock, to afford increased protection against interference from the outside of the door, preventing the falling out of the key, its being forced out by a burglar, or being taken out by children and lost. The improvement also affords protection against picking by automatically closing the keyhole by the operation of the key in locking the door, also preventing listening or peeping through the keyhole of the locked door by outsiders.

WINDOW SCREEN.—Harley E. Moyer, Conway Springs, Kansas. An outer frame, as provided by this invention, has aligning sockets in the opposing rails, a screen-covered frame with one of its bars perforated fitting in the outer frame, while a pintle in one bar of the screen-frame engages one of the sockets of the outer frame. A beaded pintle fits in the aperture of the screen-frame and the socket of the outer frame, and has a laterally projecting spring finger engaging a latch bolt secured to the screen frame. The device is readily removable, and the windows can be cleaned on both sides of the sash at any time.

DISINFECTING APPARATUS.—Frederick J. Mitchell, New York City. In this apparatus an atomizer adapted to draw from a disinfecting fluid receptacle is also connected with a compressed air reservoir by a pipe in which is an automatically operating valve, the discharge nozzle of the atomizer being connected with the object to be disinfected. The invention also provides for the automatic operation of the apparatus by hydraulic or equivalent power or by a pump, for the disinfection of drains of all descriptions, soil pipes, waste pipes, or for disinfecting the atmosphere of a compartment.

DUMPING MECHANISM.—Thomas Wright, Jersey City, N. J. This invention relates to coal or other freight dumping wagons, providing therefor a novel and effective adjusting mechanism, the body elevating mechanism being automatic in its adjustment from a folded condition to a complete elevation, effecting a sufficient inclination of the body rearwardly for the speedy and certain discharge of the load in bulk. After the load is discharged by gravity, the wagon body automatically returns to its place, the parts being then folded.

HAME STAPLE.—Riley Stoner, Grand Junction, Col. This staple comprises two independent limbs converged on inner faces at the same ends, a sleeve block fitting between the converged faces, while a clamping bolt engages perforations of the limbs and sleeve. The construction is such as to obviate abrasive wear on the body of the bolt which connects the limbs of the staple with the sleeve block that forms the bight of the latter, renders the staple strong and light and permits the ready removal and replacement of worn parts.

DETACHABLE PAD FOR BREAST STRAPS.—Gustav L. Heyman, Carlisle, Ky. This is a harness pad consisting of a rubber air chamber formed in one piece, with marginal overlapping lips or claws projecting upon the opposite side from the bearing surface of the pad. It is cheap and easily fitted to any breast strap, breeching or belly band, by means of its overlapping lips or claws, and is always smooth and pliable when inflated, preventing chafing and keeping the bearing surfaces of the animal cool and comfortable.

DENTAL PLUGGER.—James W. Dennis, Cincinnati, Ohio. Two patents thus entitled have been granted this inventor for an instrument having a yielding working face and especially adapted to facilitate the introduction of amalgamating filling into the cavity of a tooth, the yielding surface of the plugger conforming in a measure to the contour of the surface of the tooth being treated. In one case the working surface of the plugger consists of a removable shoe, preferably of soft rubber, and in the other the plugger has a socket in which a tip of yielding material is adjustably held to turn, so that by the use of the instrument the amalgam will be rapidly and efficiently distributed and the mercury worked to the surface of the filling, from whence it can be readily removed, leaving a very hard and unshrinkable filling in the tooth.

DENTAL MATRIX. — This is a further improvement of the same inventor in matrices to be placed between the teeth to form a temporary wall for the cavity to be filled. The matrix comprises two plates adapted to embrace the edges of opposing teeth, the plates each having a rib, while a wedge with a longitudinal groove in its side face is adapted to be inserted between the plates. By making the ribs of softer metal than the plates, the wedge member when forced in does not grate upon a hard surface.

DENTAL CLAMP. — According to another invention of Mr. Dennis, the body of a dental clamp is so made that the jaws are readily removable, enabling a number of jaws to be fitted to a single body, the jaws being made in pairs and differently shaped to fit variously formed and inclined teeth. The jaws may also be adjustably located in the body of the clamp, and thus accurately fitted to a tooth, and the bearings or inner faces of the jaws are of yielding material, such as soft rubber, enabling the clamp to be used on extremely sensitive teeth without pain to the patient or without lacerating the gums.

FILLING FOR TEETH AND FILLING THE TEETH are the titles of two additional patents also granted Mr. Dennis, the filling being especially prepared in stick form, so that particles may be removed and inserted in the cavity as a basis filling. The prepared filling is composed of copper, gutta percha and zinc, and the filling is designed to be an efficient preventive and arrester of decay, while capable of holding by amalgamation an indestructible cover or wearing surface. The process of filling patented consists in applying to the cavity a basis filling, faced with an amalgamating metal in a comminuted state, or in the form of filings applied to the facing, the interior copper or plastic filling being thus protected by a strong and reliable outer filling of gold or other suitable metal.

GARMENT PATTERNS. — Marie Tucek, New York City. This inventor has devised a new method of laying out and cutting patterns or garments, requiring but few measurements and comparatively little skill. For waists, a system of lines composed of a waist line and perpendicular lines are produced upon the material, with a line at an acute angle to the waist line and lines parallel to the acute angled line. On these lines are transferred measurements obtained from the body, in conjunction with unit measurements, thus laying out the individual parts of the pattern or garment, each part being laid out complete before the draughting of the next adjoining part is commenced.

GARMENT SUPPORTER.—Emma and Herbert Johnston, Cincinnati, Ohio. This is a simple device for attachment to one garment for the support of another garment, being especially adapted, when attached to the corset, for holding up ladies' skirts. It consists mainly of a wire spring frame, with an eccentric pintle and spring tongue, a pin secured to the pintle engaging the tongue. The device forms an efficient and quite inexpensive fastening.

BELT HOOK SLIDE.—Louis Sanders, Brooklyn, N. Y. This is a slide which may be attached to a belt which is on or off the person, the slide affording a support for the skirt and keeping the skirt band concealed beneath the belt. The slide is also so made that the belt will be prevented from wrinkling or puckering. The slide has an ornamented body on the outer face of the belt, and carries a pin extending down behind the belt, this pin engaging an eye at the lower end of the body and having at its lower end a hook. An auxiliary pin prevents the sliding or puckering of the belt.

CHEESE CUTTER.—Frederick J. Siewers, Galena, Ill. In this machine the cheese is supported on a platform or table connected with a dial, the moving of the platform a certain distance causing the dial to indicate a pound or fraction thereof or any desired weight, when a knife will be brought into operation to cut the exact amount designated on the dial from the cheese. The cut is made on a line drawn from the center, the operative mechanism of the dial having been previously set in accordance with the known weight of the entire cheese.

BUNDLING CIGARS.—Domingo Acosta, Key West, Florida. This inventor has devised a bundling cabinet of compact and inexpensive construction, which may be folded in a small and convenient package, and with which cigars may be bundled in any desired quantities, the cigars being thus held in uniform shape prior to bundling.

MECHANICAL TOY.—Abraham Martin, London, England. In this toy a magnetized spindle is mounted to rotate in bearings, while an armature is held by magnetic attraction in driving contact with the spindle, the armature carrying a figure or object to which eccentric movements are imparted by the revolution of the spindle, thus moving, in a manner not readily apparent to the beholder, toy ships, dancing figures, etc.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

MANUEL PRATIQUE DE L'AERONAUTE. Par W. de Fonvielle. Paris: Bernard Tignol, editeur. Librairie Scientifique, Industrielle et Agricole. Pp. iv, 246. Price $1.25.

There are constant inquiries for books on balloons, giving practical information on ballooning and other subjects connected with the aeronautical science. Here at last we have the subject treated from the point of view of the practical aeronaut, with numerous illustrations, practical recipes, and advice on the subject.

THE FURNACE WORK MANUAL. An exposition of furnace work in all its branches. Compiled from files of the American Artisan. By Sidney P. Johnston. Chicago: The American Artisan Press. 1895. Pp. 268.

This thoroughly practical treatise, illustrated by over 200 cuts, treats of furnace work proper, tells how the pipes should be cut, how they should be laid and connected, and describes the construction of furnaces, all the details of pipes, dampers, and the minutiæ of hot air heaters. It is evident that it covers a ground heretofore but little treated, as this book works from the standpoint of the practical furnace builder or plumber who is called upon to introduce furnaces into houses. We anticipate for this book a circulation proportionate in great measure to the amount of interest taken by this class of artisans in their business, and in proportion to the height of the ideal which they have formed of their profession.

THE UNIVERSITY TUTORIAL SERIES. A text book of statics. By William Briggs and G. H. Bryan. London: W. B. Clive. Pp. vii, 220. Price 60 cents.

A cursory view of this work impresses one most favorably with it. Although it is an English book, it, fortunately, is not one that is restricted to one of the syllabus courses, but is simply intended to be adapted to the wants of the elementary student. With its very excellent illustrations, table of contents and answers to problems, little need be said about the absence of an index, for it hardly seems to be needed.

THE UNIVERSITY TUTORIAL SERIES. A text book of dynamics. By William Briggs and G. H. Bryan. London: W. B. Clive. Pp. 192, xiv. Price 80 cents.

What has been said about the preceding work applies equally to this one. The nice make-up of the book, its clear printing and excellent arrangement, go to impress one most favorably with it, and incline us to recommend it to our readers.

THE DYNAMICS OF LIFE. AN ADDRESS DELIVERED BEFORE THE MEDICAL SOCIETY OF MANCHESTER, October 3, 1894. By W. R. Gowers. Philadelphia: P. Blakiston, Son & Company. 1894. Pp. 70. Price 75 cents.

The author, in this treatise, which is an address reprinted from the pages of the Lancet, endeavors to account for the dynamics of the living being. How successful he is can only be judged by a full perusal of the work. Anything of the sort makes interesting reading, and we think that the work, short as it is, deserves an index.

SCIENTIFIC AMERICAN BUILDING EDITION.

JANUARY, 1895.—(No. 111.)

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2. A Colonial residence at New Rochelle, N. Y., recently erected for J. O. Noakes, Esq., at Iselin's Park. Two perspective elevations and floor plans. Cost $5,000 complete. Mr. Manly N. Cutter, architect, New York City. An attractive design.
3. Colonial residence at Montclair, N. J., recently erected for Sylvester Post, Esq. Two perspective elevations and floor plans. Messrs. W. S. Knowles & A. H. Thorp, architects, New York City. A pleasing design.
4. A seaside cottage recently erected for C. H. Manning, Esq., at Kennebunkport, Me. Two perspective elevations and floor plans. A picturesque and unique design after the "New England" lean-to roof order. Mr. H. P. Clark, architect, Boston, Mass.
5. A residence at East Orange, N. J., erected at a cost of $7,000. Architect Mr. W. F. Bower, Newark, N. J. Perspective elevation and floor plans.
6. The First Presbyterian Church at Stamford, Conn. Two perspective elevations and ground plan. A design of great architectural beauty, treated in the Romanesque style. Mr. J. C. Cady, architect, New York.
7. A residence at Scranton, Pa., erected for E. B. Sturges, Esq., at a cost of $5,000 complete. Architect Mr. E. G. W. Dietrich, New York City. Perspective elevation and floor plans.
8. A summer residence at Cushing's Island, Me., recently erected at a cost of $3,100 complete. Two perspective elevations and floor plans, also an interior view. Mr. John C. Stevens, architect, Portland, Me. An excellent example for a summer home.
9. View of the Armory of the Seventy-first Regiment, New York City. Architect Mr. J. R. Thomas, New York City.
10. Perspective view and floor plans of the fourteen story Reliance Building, Chicago.
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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(6375) T. D. L. asks: Can a permanent magnet be made equally as strong as that of an electro-magnet wound by any desired strength? A. No; an electromagnet may be much stronger.

(6376) E. C. S. writes: In a recent discussion as to the velocity of falling bodies, I made the general statement that all bodies fell with equal velocity, recognizing, of course, the apparent exceptions, such as feathers, etc. Will you kindly throw some light on the matter, as one of our local scientists maintains that a heavy body will fall with greater velocity than a lighter one. The Encyclopedia Britannica, under the head of gravitation, states that bodies fall to the earth with equal velocity, irrespective of material of which they are composed. Upon this and the fact that there is a rule giving the velocity of falling bodies 16·1 feet for the first second, etc., I base my opinion. A. The law of falling bodies applies to bodies falling in vacuo. In the air a heavy body, cæteris paribus, falls faster than a light one. The Encyclopedia Britannica statement applies to a vacuum. The air offers very high and generally underestimated resistance to falling objects.

(6377) H. A. says: Can you give a good recipe for renewing the ribbons of typewriters with record or with copying ink of different colors? A. Take vaseline (petrolatum) of high boiling point, melt it on a water bath or slow fire, and incorporate by constant stirring as much lamp black or powdered drop black as it will take up without becoming granular. If the vaseline remains in excess, the print is liable to have a greasy outline; if the color is in excess, the print will not be clear. Remove the mixture from the fire, and while it is cooling mix equal parts of petroleum, benzine, and rectified oil of turpentine, in which dissolve the fatty ink, introduced in small portions by constant agitation. The volatile solvents should be in such quantity that the fluid ink is of the consistence of fresh oil paint. One secret of success lies in the proper application of the ink to the ribbon. Wind the ribbon on a piece of cardboard, spread on a table several layers of newspaper, then unwind the ribbon in such lengths as may be most convenient, and lay it flat on the paper. Apply the ink, after agitation, by means of a soft brush, and rub it well into the interstices of the ribbon with a tooth brush. Hardly any ink should remain visible on the surface. For colored inks use Prussian blue, red lead, etc., and especially the aniline colors.

Aniline black	½ oz.
Pure alcohol	15 "
Concentrated glycerine	15 "

Dissolve the aniline black in the alcohol, and add the glycerine. Ink as before. The aniline inks containing glycerine are copying inks.

(6378) The F. R. Co. asks: 1. Is it possible to charge an electro-magnet with the secondary current from an induction coil? If so, please name the best form of construction. A. Not to advantage. It requires a very long coil and involves loss of efficiency. 2. Your description of the magneto bell requires the L shaped piece which holds the armature to be a permanent magnet. Why is this necessary? A. To polarize the electro-magnet.

(6379) P. asks: 1. What advantages are claimed for metol as a developer? Could you give me a receipt for a developer containing it, and directions for use? One with which I can have most control over the plate, and which will keep when mixed for use, as I often want to develop one or two plates at a time. A. Metol is very energetic in its action, has remarkable staying qualities, keeps clear, does not stain the film in the shadows, and is easy to work. The following is a good formula:

Metol	5 grains.
Sodium sulphite crystals C. P.	25 "
Water	1 oz.

Dissolve metol first, then sodium sulphite. If kept in a tightly corked bottle, the solution will remain colorless for two or three months. This is a stock solution. To develop a 4×5 plate, take 1¼ ounces of the above, add ¾ ounce water and pour over the plate; if fully timed, the picture will gradually appear and rapidly gain density and detail. If the time has been short, add to the solution a few drops, four or five at first, of a carbonate of potash solution, prepared by dissolving one ounce of potash in three ounces of water. Keep adding a little at a time until the development proceeds rapidly enough to suit. The used developer should be kept in another tightly corked bottle. Eight 4×5 plates can be developed with these 2 ounces of developer. At end of that time development will be very slow and the developer will have a peculiar pungent odor when the nostrils are placed near it. This signifies that it is ready to be thrown away. 2. An easy way of regaining gold from waste toning solution. A. Gold may be recovered from waste toning solutions by adding a solution containing 32 grains of proto-sulphate of iron to every gallon of waste. The gold will be precipitated to the bottom. The clear liquid should be drawn off by a siphon and the residue poured upon a filtering paper and washed by pouring over it boiling water until the wash water no longer produces a precipitate with a solution of barium chloride. The gold is now redissolved with aqua regia and the solution slowly evaporated to dryness over a sand bath. The yellow crystalline salt may then be dissolved in water to make up a fresh toning bath, or put in an air-tight bottle. 3. What can I use to finish off the woodwork of a camera (tripod)? A. Fill the grain of the wood with a filler of appropriate color, and when dry give the tripod a flowing coat of shellac varnish.

(6380) C. K. H. asks: 1. What is considered the best material to put between the flooring to deaden sound? If felt or paper will do, what kind is the best? The floor is of a hall over a store and is to be sound proof, at the least expense. As parties are figuring on putting in an electric lighting system in the building, a plant of from 100 to 150 incandescent lights, and running same with a gasoline engine, will you give an idea of which is the best engine and dynamo for the purpose and the cost of same? It will require from 10 to 15 horse power we are informed. A. A double floor with mortar between is probably the best sound insulator. For the address of engine and dynamo builders we refer you to our advertising columns. 2. Do you think it practicable to install an electric lighting plant for stores or hall and run same successfully with a gasoline engine? A. Gasoline engines have been successfully used for electric lighting; we believe they have proved to be economical.

(6381) J. H. L. asks: 1. How shall I wind the fan motor described in SUPPLEMENT, No. 767, so as to be suitable for a 100 volt circuit? A. We advise you not to try the motor on a current of such potential. You might wind with No. 26 wire and start with a rheostat. 2. Where can I get instructions for making a voltmeter? A. See our SUPPLEMENT, Nos. 556, 552, and 353, for descriptions of voltmeters. 3. Where can I get instructions for making a small fan motor of the alternating induction type? A. For alternating current motors, see our SUPPLEMENT, Nos. 601, 653, 692, 717, and 944. These describe different motors, but do not give full working details.

(6382) E. P. B. asks: 1 Is it feasible to make a storage battery for electric light work of one lead plate for a positive pole and a single zinc stick for a negative pole? A. This is hardly feasible. 2. State the amperes needed to charge 144 square inches (all told) of positive plate? A. 5 amperes. 3. What is the discharge for the above surface? A. 5 to 6 amperes. 4. Is asbestos a perfect insulator? A. Nothing is a perfect insulator; dry asbestos is almost a perfect one.

(6383) W. A. H. asks how to wind an induction coil, for use on a Hunning's transmitter. Crowfoot gravity batteries, three in number, to be used. I wish to know size and quantity of wire to be used on both primary and secondary. Which will give best results on Hunning's transmitters—open circuit or gravity cells? A. Wind primary to ½ ohm with No. 24 wire, secondary to 80 ohms with No. 36 wire. Use open circuit batteries; the Crowfoots will tend to local action by deposition of copper on the zinc.

(6384) A. N. X. asks: To persons using the same living rooms with a victim of consumption, and where cuspidors are used indiscriminately, is there any danger from contagion? A. There is no doubt that the practice is dangerous. Use individual cuspidors and place disinfectants, such as zinc sulphate, in them. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 782, 824, 959, and 973, for articles on consumption, its cure, prevention, etc.

(6385) S. J. R. asks: 1. How can I make a good but inexpensive microphone? A. See our SUPPLEMENT, No. 163. 2. I have two Samson batteries on a burglar alarm system. Before retiring last night I tested the alarm and it worked all right. About an hour after I heard a noise resembling an explosion, and opening the closet, in which I keep the batteries, I found that one of them had burst all to pieces, and the fluid was thrown all over everything. A. Possibly the glass battery jar was badly annealed. This or some accident throwing it down are the only causes assignable.

(6386) W. H. B. asks how to proportion a primary spark coil to get the best results with the least amount of material, to best adapt it to a battery of known amperage and voltage. A. The calculation cannot be made except approximately. The voltage to be developed must be known. Then the size of core and turns of wire must be based on the ratio of 10^8 lines of force cut per second for one volt produced. The great trouble is in the leakage coefficient for the lines of force.

(6387) F. X. W. asks: In regard to eight light dynamo in SUPPLEMENT, No. 600, what alterations, if any, are necessary in winding, to change said dynamo into motor, and what horse power would it develop if used as a motor? A. Wind in shunt. The size of wire depends on the voltage. It would give about one-half horse power.

(6388) F. W. G. asks how many volumes a mixture of gas and air—10 to 1 (at ordinary pressure) makes on explosion. A. It depends on the composition of the gas; from 6 to 10 times the original volume, but instantly going back to about the original volume.

(6389) C. R. B. asks: How much rainfall a fall of 12 inches of snow would represent, and if the snowfall of a year is counted in making up the report of the annual rainfall? A. If light snow, it would give a little over an inch of water. To get accurate results, the snow must be melted so as to give a determination for every snowfall. The value of the snow in water counts as rainfall.

(6390) P. E. A. asks: Can a person see the stars in broad daylight by descending into a deep well which is in darkness and looking up to the sky? How many feet down would a person have to descend? A. Stars can readily be seen in the day time from the bottom of deep wells and mines. A hundred or more feet down is sufficient. Stars of the 3d and 4th magnitude are about as small as thus can be seen.

(6391) W. D. asks: What is the process of cleaning sea shells to make them look bright and clean? A. Dark-colored organic matter on the outer surface is first removed by making a thick mixture of one part bleaching powder to two parts of water and soaking the shell therein. On removing wash and scrub it. Thick incrustations of lime must be picked off with a sharp-edged hammer or some similar tool, and then the shell must be dipped in boiling dilute hydrochloric acid. Valuable shells may have the face or pearly portion covered with shellac varnish, which may be removed with alcohol after the acid bath. For strong, heavy shells use 1 acid to 3 of water; for delicate shells use 1 part acid to 10 of water. Dip the shell for a second only, wash and examine; if not enough, give it a second dip. Hold it in wooden forceps or attach it to a stick in any way to serve as its handle. The important point is not to let the acid stay long on the shell. For local spots it may be applied with a brush.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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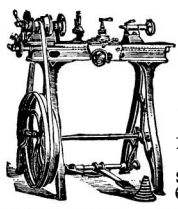

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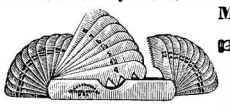

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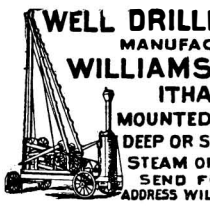

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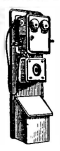

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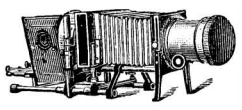

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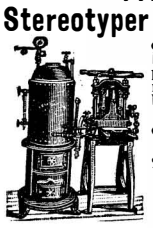

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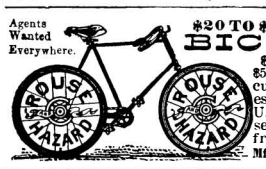

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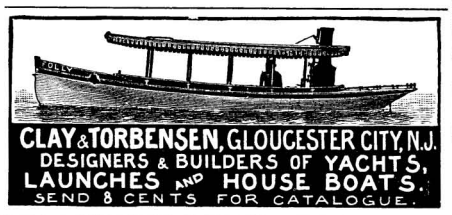

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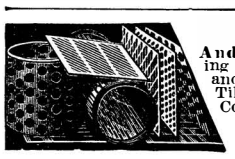

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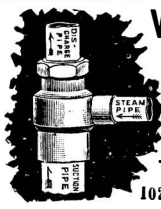

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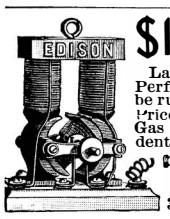

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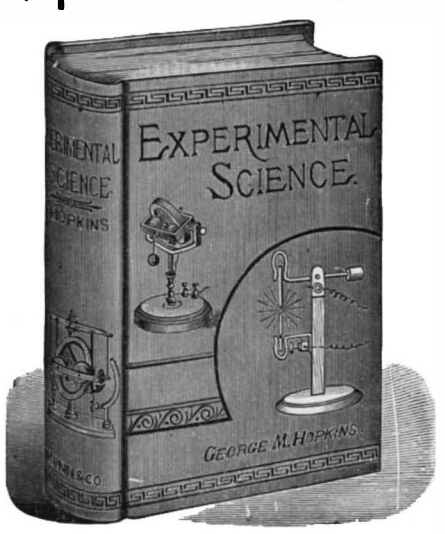

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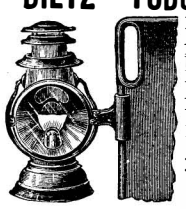

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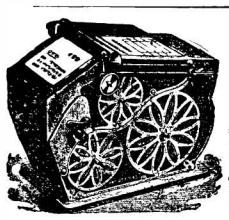

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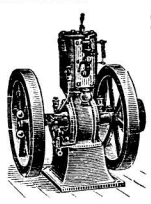

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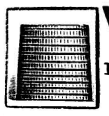

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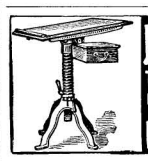

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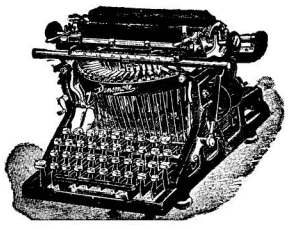

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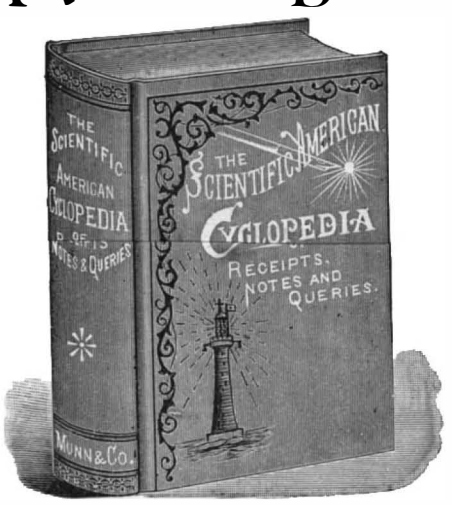

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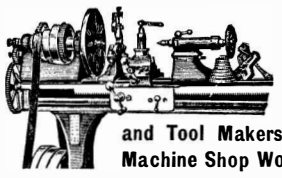

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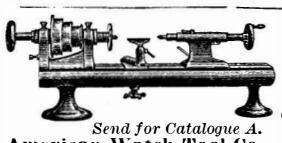

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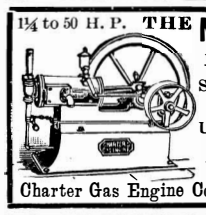

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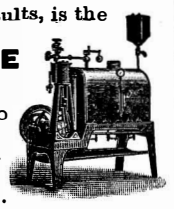

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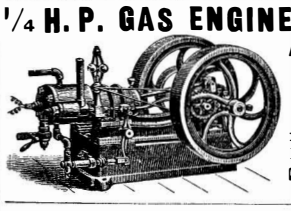

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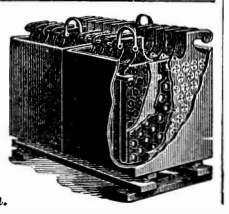

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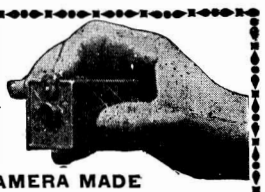

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